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Foreword

Welcome to the 11th International Postgraduate Research Conference (IPGRC13), which is hosted by the School of the Built Environment, at the University of Salford Media City Campus. The school currently has over 250 postgraduate researchers engaging in Full Time, Part Time, Professional Doctorate, Split Site and on-line doctoral programmes, enjoying a vibrant and multicultural research environment with researchers from diverse backgrounds.

This conference creates a wonderful vehicle for researchers from Salford and other parts of the world, to share their research passion and outputs and network within a professional and friendly environment, with high profile academics and leaders within the built environment.

This year's conference brings together participants from a broad range of UK universities, Ireland, Denmark, Brazil, Netherland, Russia, Egypt, Libya, Qatar, UAE, Saudi Arabia and Iraq. The conference received 214 abstracts, 125 papers submission, while 97 papers and 17 posters have been accepted under the following themes:

- Business, Economics and Finance
- Design and Urban Development
- ICT, Technology and Engineering
- People, Skills and Education
- Property and Project Management
- Sustainability and Environmental Systems

These themes bring to the surface the diverse nature of Built Environment research which contributes toward and challenges, timely issues facing the construction industry and stakeholders involved within academia and industry.

On behalf of School of the Built Environment, and the conference co-chairs & organisers, we wish you an enjoyable and fruitful experience and thank you and your sponsors for your attendance and for making this conference happen.

Professor Vian Ahmed
Conference Chair
Director of Postgraduate Research Studies
School of the Built Environment
University of Salford
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Business, Economics and Finance

Improving the Libyan Customers' Trust and Acceptance for Online Banking Technology

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Abstract

An exploratory study of customers, trust and acceptance of online banking technology is conducted in a Libyan bank. The main aim of this study is to develop a framework for improving trust and acceptance of online banking. This study examines customers' related factors that may affect the trust and acceptance of online banking (such as ease of use, relative advantage, intention, trust and risk) as well as customers' demographic profile and their level of technology (technology readiness). The results suggest that trust and acceptance of online banking are not only affected by complexity or relative advantages, but are also related to customers trust and satisfaction. Accordingly, it is argued that online banking is strategically important to the banking sector in emerging country like Libya.

Keywords

Customers, Libya, Online banking, Trust.

Introduction

Libyan banks continue to conduct most of their banking transactions using traditional methods. Given the prevalence of online technology adoption by the banking industry in developed countries, there is a growing interest to identify the reasons for the absence of such technological innovation in developing countries such as Libya. This study considers various factors that might affect the likelihood that a given technology can be trusted and accepted by the customers of the banking industry in developing country like Libya. Data were collected using quantitative method by questionnaire survey distributed to more than 200 carefully selected Libyan bank customers. The data were based on customers' decisions whether or not to trust online banking technology in Libya. This study develops a framework for the trust and acceptance of online banking technology. It thus addresses the question: How can the Libyan bank customers' trust of online banking be improved?

Background to the study

The new financial system has brought up new concepts, structures and strategies for retail banking, and banks across the world are now facing new prospects and challenges. Internet the driving engine of the new economy has given birth to online banking, a new and increasingly popular way of banking for most customers nowadays (Mukherjee & Nath, 2003). Online banking for customers refers to several types of banking activities through which bank customers can get information and carry out most retail banking services. Online banking services such as balance

reporting, inter-account transfers, bill payment among others, can be carried out by the customers simply through a telecommunication network without leaving their homes or offices (Danial, 1999; Mols, 1998; Sathye, 1999). The usage of online banking provides information of products and services through network or telecommunications technologies, leading to establishment of digital value (Jones et al, 2000). Since the services provided by banks are commonly based on information (Bradely and Stewart, 2002), those services can be computerised and automated with ease (Porter & Millar, 1985). Commonly online banking technologies are deemed by many banks as a way to gain their customer's trust and satisfaction and also consider for improving the service quality (Robinson, 2000).

Researchers and practitioners such as Moenaert & Lievens, 2000; Daniel, 1999; Keyes, 1999; Pikkarainen *et al*, 2004; Nikola *et al*, 2002; Richard, *et al* 2003; Lassar, *et al.*, 2005, gives similar insight and scope to the online banking by describing it as a system, which enables banks's customers to access their accounts to carry out transactions and acquire information through electronic communication channels such as tele-banking, home banking, Auto-Teller machines (ATMs) and internet banking (Abukhzam and Lee, 2010).

The need for online banking technology is evident and well publicised. For example, Nehmzow and Seitz (1997) expressed that traditional way of banking such as processing paperwork and cheques, and cash transfer between banks and customers is the most costly way of banking (Abukhzam and Lee, 2010). In addition Kerem (2003) stated that the complex requests of bank customers, such as bill payments, cash withdrawals, loan applications and cheque clearings was huge task for traditional banks, thus there was a clear need for customers to trust and accept technology to automate back office duties (Keyes, 1999).

Moreover, the technology creates new market places and opportunities for banks. It reduces physical trade difficulties, increases market access and trade efficiency (Seitz and Stickel, 1998). From the customer's perspective, the online banking system has additional convenience, functionality and accessibility (Mols et al, 1998). Bank customers argue that branch banking takes much more time and efforts, whereas the costs of banking services are dramatically reduced when they are accessed through online banking channels (Sohail and Shanmugham, 2003). At the same time online banking technology brings with it a number of challenges such as technology cost, privacy, legal and security issues (Sathye, 1999; Davis et al, 1989).

The level of trust and acceptance in online banking technology is different from one culture to another across the world. For instance, the level of trust and acceptance of online banking technology in USA, Western Europe and Asian Pacific countries seems very high, but in developing countries such Arab nations it is very low (Aladwani, 2001).

Banks in Arab countries have recently acknowledged the benefits of online banking technology in improving their productivities, efficiencies and customers' trust. However, some banks in Arab countries such as Libya have struggled to provide their customers with online banking technology within its existing banking system (Khalfan and Akbar, 2006; Touati, 2008; Abukhzam and Lee, 2010).

The reasons for that not because of their ability to afford the technology, but it related to customer's trust and acceptance issues. (Khalfan and Alshawaf, 2004).

Arabic academic researchers (e.g., Aladwani, 2001; Kamel and Hassan, 2003; Khalfan and Alshawaf, 2004; Touati, 2008; Abukhzam and Lee, 2010) pointed to a mixture of lack of basic technological infrastructure, low level of computer literacy and education, lack of trust and awareness in technology among bank customers, shortage of IT skilled personnel, technology investment costs and IT language differences have all been found to make online banking unattractive in Arabic countries in general and Libya in particular.

In reviewing literature in the wider domains of online banking and technology trust, it seems that previous research studies have primarily focused on technology adoption from the individuals within organisational structure- bank managers and their employees - while limited consideration has been given to the individuals outside the organisational structure – bank customers. Thus most studies have covered the trust and acceptance in online banking and related factors rather broadly from the customer's point of view with little detailed attention paid to the factors that influence the online banking trust and acceptance from the perspective of bank customer (Mols, 1998; Luhmann, 2000). Thus, perception and attitude of bank customers' about the trust and acceptance of online banking will be studied in this research. Davis *et al* (1989) argued that customers build up trust, attitude and feeling about the new technology that could direct them to the acceptance or rejection of the proposed technology. Customers may have different feeling or attitude related to their cultures and as this study is focusing on Libyan customers, the Libyan banking environment and online banking technology will be investigated.

Technology level in Libyan banking industry

The level of technology in the Libyan banking industry in general is limited, and is still in its early stages (Economic Forum, 2007). The development of Libyan banks faced many obstacles in the past ten years. The international sanction that was imposed against Libya, which lasted nearly eleven years from 1992 to 2003 (Wikipedia, 2008c), had a significant impact on the Libyan economy in general. The banking system in particular, was isolated from communicating with other advanced banking systems and access to modern information technologies. Other reasons include the unreliable national telecommunications infrastructure, lack of education between bank customers, lack of technological knowledge among bank staff and customers. The long distances between bank branches and their headquarters are also slowing down the development of Libyan banking system (Danowitz et al, 1995).

Recently, to keep up with the rest of the world, Libya has been trying to introduce online banking facilities to promote the use of efficient services to customers, which will enable the banks to be competitive and to encourage the trade with foreign investors (CBL, 2007). This can only be achieved by the trust of modern banking technology such as online banking technology (Danowitz et al, 1995).

Recently and as an exceptional circumstance, Libya endured an internal conflict for more than eight months which ended in a regime change after four decades in power. Now, the country is gradually returning to normality. Banks and other financial institutions work in exceptional circumstances, with shortage of money, few hours opening and less security provided.

Libyan banking Customers

Bank customers are the persons who use or deal with the bank as they benefit from its services and technology.

The Libyan banking Customers can be divided into three types regarding their educational, technology, Internet, and online banking knowledge which are: (Human Development Report, 2009)

- Illiterate customers (this type of people usually includes elderly people, aged over 60 years);
- Educated customers without computer knowledge (this group usually comprises customers in the age group [25-46];
- Educated customers with computer knowledge and have a limited or no access to online banking (this group of customers can be the same as the previous one).

According to the Human Development Report (2009), Libya is ranked 60 in the world in term of poverty where 13.4% in a population of 5 Million live below the national poverty line. This may indicates that there are an important number of people who may not be considered in term of both online banking and wide range of developments. Moreover, adult literacy rate for people aged 15 and above is not of a concern if compared to the fast growing population and the country's development in different aspects such as education, IT, and banking systems (Touati, 2008).

In summary, the banking technology usage rate in Libya is at present very minimal, despite the fact that Libya is one of the wealthiest countries in Africa as it is a major oil producer and one of Europe's biggest North African oil suppliers (Touati, 2008). The Libyan banking industry is now lagging behind and in extreme need of essential change to enhance its banking system, as it has been continuously criticised for its inadequate and inefficient services (Libyan Investment, 2004). These processes require extensive and comprehensive study of online banking related factors in order to achieve customers' trust in online banking technology. This study aims to accordingly address this research gap.

Online banking trust and acceptance framework

This study introduces a framework for the trust and acceptance of online banking technology. The framework was grounded by technology adoption and acceptance theories. These theories including technology acceptance model (TAM), theory of reasoned action (TRA) and trust related theories such as trust and risk theory. The framework explains clearly the relationships between factors in this study by identifying the key factors and determinants that affect customers trusting and accepting online banking technology.

By explaining both TRA and TAM, three main direct determinants are proposed: acceptance which includes (relative advantages, ease of use), perceived trust and risk/issues and online banking issues which includes (security issues, technical and legal support issues, reputation issues, privacy issues, transactional/operation issues). Technology adoption frameworks like the TRA and TAM offer effective theoretical bases for factors contributing to customers' acceptance of new technology. They have been successfully applied in customer behaviour, technology acceptance and system use, and variety of instances of human behaviour.

The practical utility of considering TAM is that the online banking is a technology-driven behaviour. Given the uncertain environment of online technology, trust and issues/risk are theorised as direct of intentions. In addition, trust and issues/risk are viewed under the online banking challenges that face customers. Moreover, technology readiness and demographic characteristics (age, gender, occupation, educational qualifications, Internet experience and online banking experience) are proposed as having a moderating effect on the relationship between intention and challenges affecting customers trust and acceptance. Figure 1 represents the research framework developed for the present study.

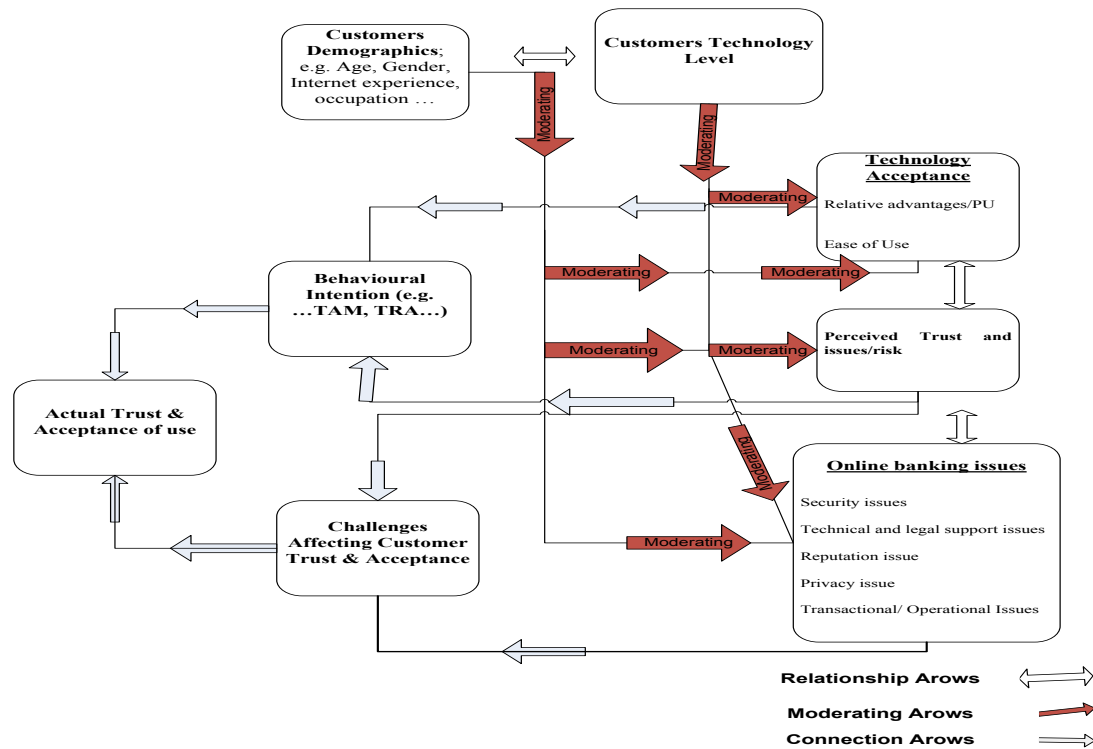


Figure. 1. A framework to improve the trust and acceptance of Libyan customers in online technology

To accomplish the main aim of the study, a survey questionnaire has been chosen as a primary research method. Questionnaires enable access to a wider spectrum of views and opinions. The responses are predefined, specific or limited by the use of a range of answers that the respondents select (Likert scale). This study targets the customers of the Bank of Commerce and Development (BCD) in Libya including customers who are currently employees of the BCD. The data is gathered by means of a drop and collect survey during the third quarter of 2010. The process was carried out in two steps:

- 1 - A sample of the former bank was identified from various sources that focus on banking and finance activities.
- 2 - Because of the time and budget limitations, and experience of Libyan firms' unwillingness to take part in telephone/postal/email surveys due to the Libyan instable situation, unreliable mailing and postal systems, the current research data collection was conducted by using drop and collect survey.

This technique is less expensive and consumes less time than other methods such as interviews. Therefore, the researchers usually use this method of data collection in Libya (Hunaiti et al, 2009).

Sample analysis

This section describes the sample space and the demographics profile of the respondents. The aim of this section is to explore the response sample in relation to their bank account, use of internet, internet experience, online banking (O.B) experience, amount of money spent on online banking (O.B), gender, age, qualification and occupation.

Overall sample demographic profile

The demographic profile of the respondents is displayed in figure 2. It shows that 26% of the respondents were female and 74% male. The largest age group consisted of those aged 26-45 years with 67%, followed by the age group 46-60 years with 18% and the age group 18-25 years with 15.1%. The education level of the participants is distributed as follows: 43% had postgraduate university education, 33% had undergraduate university education and 1% had Secondary School/ College education, 22% had professional diploma and only 1% had no educational qualification. The large group of respondents with postgraduate university education indicates a strong relationship between education level and technology trust and acceptance. The occupational distribution of the respondents varied widely. The large group of respondents was technical staff or teachers with 35% followed by students with 32%, professionals with 14%, self-employed with 9%, Housewife/Husband with 6%, others with 3%, and clerical staff with 1%.

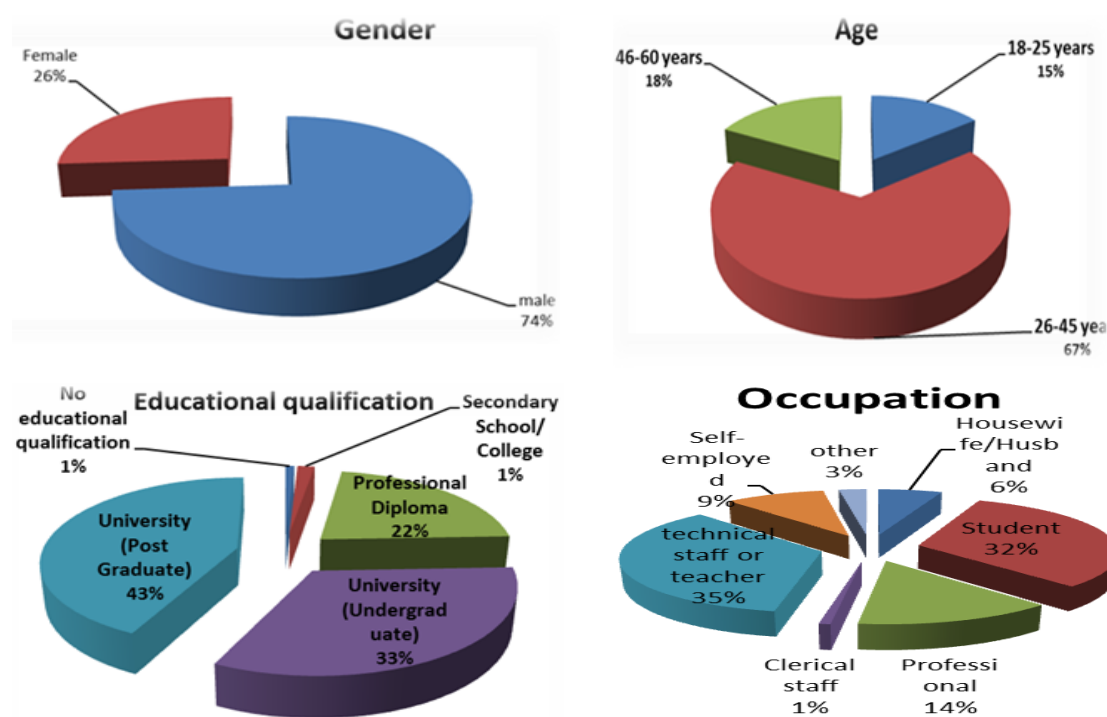


Figure. 2. Overall sample demographic profile

Regarding the pattern of internet usage, Figure 3 shows that 60% of the respondents had internet access at home and 23% use internet café. Fourteen percent were using internet at their workplaces and only 3% of the respondents had no access to internet at all. In term of internet experience of the respondents, 29% used it for 1 to 5 years, 29% used it for 6 to 10 years, 27% used it for less than 1 year, and 15% of the respondents used it for over 10 years.

The average of internet experience of the respondents was 2.59 years. However, 50% of the respondents did shop over the internet and 82% of those spent less than 50 Libyan Dinars in a single transaction. Fifty percent of the respondents did never shop over the internet. In regards to those who have a bank account and online banking experience, 77% of the respondents did use online banking for only a year, another 13% for less than 3 years, and 10% of them used the service for over 3 years.

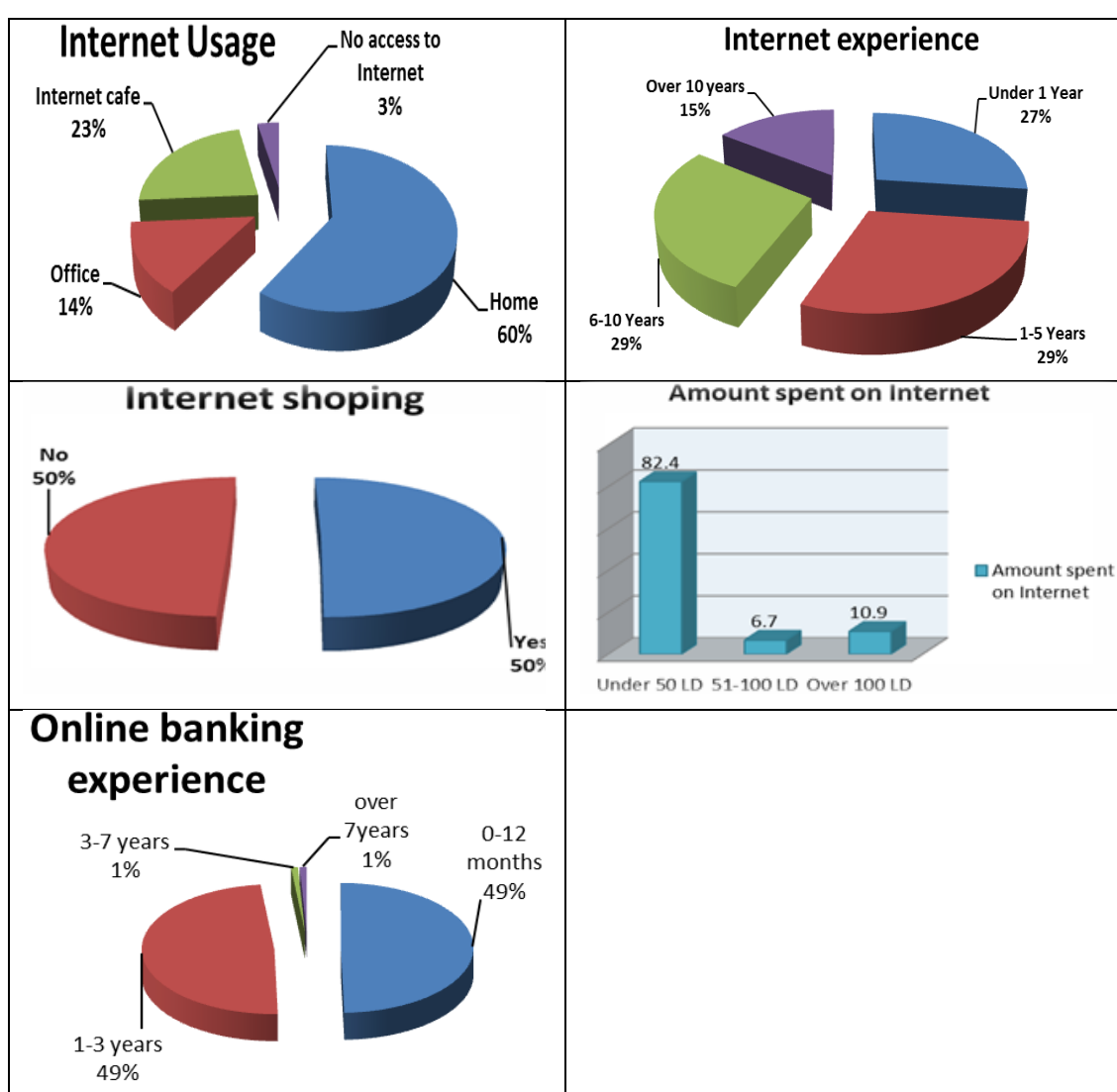


Figure. 3. Internet-related behavior of the Survey Respondents

Banking channels

The results of the analysis of the questionnaire of the banking channels are summarised in both, table 1 and figure 4. Question No. 1 was a screening question in

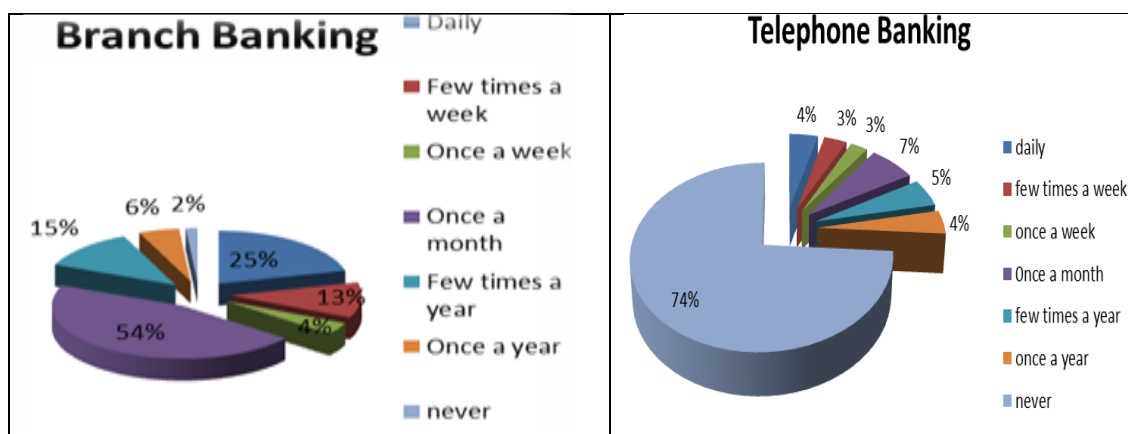
which respondents were asked about their frequency of use of four different banking channels. Figure 4 displays the percentage usage of different banking channels.

Table 1 describes banking channels with letters as (B) for branch banking, (T) for telephone banking, (ATMs) cash machine and (OB) for online banking. The reason for stating different banking channels is to show the differences in customers' intention towards banking channels. It also compares online banking in terms of other banking channels and shows how important online banking for Libyan current and perceived customers is. Using Likert scale, respondents were given multiple choices to select from and to indicate their available and preferred banking channels to conduct their banking transactions.

Table 1. Different banking channels

			Question s	Daily	Few times a week	Once a week	Once a month	Few times a year	Once a year	never
Banking channels	Q1	B		25%	12.9%	4.4%	54.4%	14.6%	6%	1.7%
		T		5.2%	4.4%	2.5%	7.7%	6%	5.2%	87.9%
		ATMs		20.6 %	12.9%	2.5%	4.4%	0.8%	6%	70.7%
		OB		4%	21%	19%	24%	5%	3%	43%

Figure 4 shows the percentage of respondents in relation to their usage of different banking channels by means of pie charts. Usage of banking channels are categorised as daily, few times a week, once a week, once a month, few times a year, once a year and never.



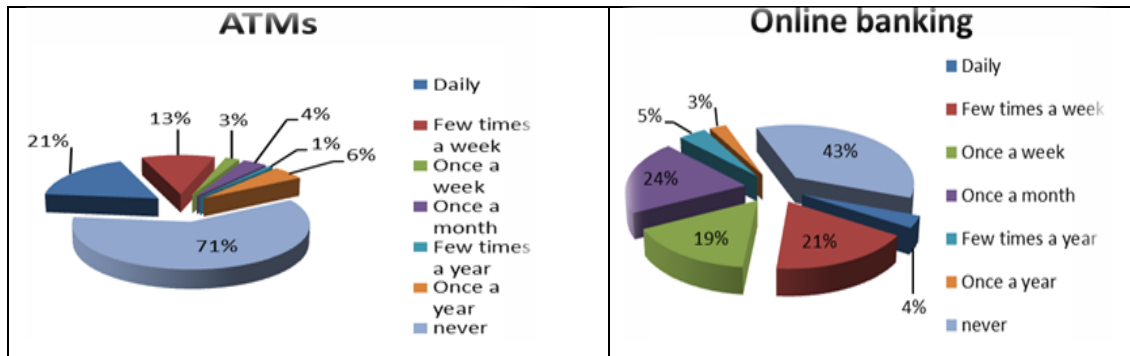


Figure 4. Different banking channels

Conclusion

In summary, this study looked at the Libyan online banking trust and acceptance in many ways and after reviewing literature on online banking technology, this study considered various factors that might act to determine whether a given technology is likely to be trusted and accepted by customers of banking industry in developing country like Libya. Data were collected using quantitative method by questionnaire survey distributed to more than 200 carefully selected Libyan bank customers'. The data were based on customers' decisions whether or not to trust online banking technology in Libya. This study develops a framework to improve the trust and acceptance of online banking technology. It thus addresses the question: How can the Libyan bank customers' trust of online banking be improved?

Quantitative data was empirically collected and analysed using more than one method using SPSS and Microsoft excel and resulted in the following findings: Regarding banking channels, half of the respondents used branch banking once a month to communicate with their bank and mostly to withdraw their salaries as they are in monthly bases. Furthermore, the majority of respondents never used telephone banking to communicate with their bank and had a limited usage of ATMs to do transactions.

However, more than quarter of the respondents used online banking to open their bank website and to communicate with it. The reason for that was because of online banking is spreading fast and is easy to use. In addition more than half of the respondents strongly agreed that 7d/24hrs bank services are very important for them. Moreover, findings related to intention, shows that the majority of the respondents agreed that they were aware of online banking technology.

In term of challenges affecting online banking such as transactional issues, found that nearly quarter of the respondents strongly disagreed that online banking transaction information will be shared with others regarding their accounts. Security issues were not exceptional as nearly third of the respondents strongly agreed that their bank provides 24 hour secure access to online banking.

Future research needs to determine the extent to which the findings of the present study can be extended to include other persons, settings, and time. One way of doing this is to extend the work to include other factors in different financial firms and banks in Libya.

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Analytic Hierarchy Process for Prioritising Critical Success Factors to Improve Management of Project Overheads

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Abstract

Project overheads are increasingly important for sustaining activities of construction projects. Management of project overheads are not explicitly addressed by the traditional costing system and current cost accounting management approaches. Critical Success Factors (CSFs) for improving the management of project overheads have not been closely studied in the past. A questionnaire survey was administered to collect opinions from experts and project professionals in this area, to examine the importance of forty CSFs for improving the management of project overheads. The results represent eight groups of important CSFs, which include: understanding the market condition (*MARCON*), project development focus (*DEVFOC*), requirement of investment and technology (*INVTEC*), mapping local availability of required resources (*LOCRES*), managing the company's interest and project benefit (*INTBEN*), managing project complexity and intricate nature (*PROCOM*), improving contractors' roles and current practices (*ROPRAC*), and requirement for a robust method and tool (*METOOOL*). The Analytic Hierarchy Process (AHP) revealed that the best three priorities of important CSFs are *METOOOL*, *MARCON*, and *PROCOM* in respect of four evaluation criteria of construction projects (e.g., project type, project phase, project monitoring, and project delivery). These findings should enable the improvement of current Cost Management and Controlling Practices (*CMCPs*) of project overheads during the construction stage of construction projects.

Keywords:

Analytic hierarchy process, construction projects, construction stage, critical success factors.

Introduction

Both academics and practitioners have shown an increased interest in studying project overheads. Assaf *et al* (2001) reported that project overheads have significantly increased its portion of the total construction costs compared to materials and labour and have become very important for sustaining all the activities of a construction project. The ratio of overheads to the total project costs typically ranged between 8 and 15 percent (Enshassi *et al.*, 2008). The average overhead cost in real projects is slightly higher than reported in the literature and is very much dependant on the variations of project complexities and the utilisation of advanced technologies.

Overheads are defined from a cost accounting view point as *'those expenses of production which cannot readily be allocated directly to particular units of production or particular productive processes'* (Bunbury, 1931, p.7). This definition indicates that project overheads are unclearly related to particular units of activities in construction process. Tatikonda and Tatikonda (1994, p.C9-1) give a definition of overheads as *'a cost item that is common to two or more cost objectives and cannot be identified specifically with any one of the cost objects in an economically feasible manner'*. This definition can be understood as focusing on explaining the process of accounting overhead costs to fulfil multiple types of activity cost objects through multiple rates of activity cost drivers. However, project overheads added on percentage basis to total building costs (RICS, 2009) that should not be included in a compound cost (CIOB, 2009), and remain unclear relations to particular activities (Jaya *et al.*, 2010a; and 2010b); consequently, it is inaccurately distributed to every activity (Jaya *et al.*, 2010c). The traditional costing system does not specifically address the management of project overheads in construction projects. The current cost accounting management approach is reliable for recording, documenting, (sometimes) interpreting, communicating, and reporting economic information (Horngren *et al.*, 1997; Glynn *et al.*, 2003; and Drury, 2008). However, the role of the cost accounting management approach is primarily criticised that it is focused too much on satisfying external standard requirements, and far too little attention has been paid for internal improvement on management of project overheads in the construction process.

This paper implements the Analytic Hierarchy Process (AHP) to analyse the best priority of importance of Critical Success Factors (CSFs) for improving the Cost Management and Controlling Practices (CMCPs) of project overheads during the construction stage.

Potential Challenges to Management of Project Overheads

The challenge of cost management and controlling begins with a lack of estimating knowledge in construction processes (Akintoye and Fitzgerald, 2000), and misunderstanding of the cost planning for detailed processes and activities. Current construction processes are arbitrarily supported with percentage overheads basis (RICS, 2009) and increasingly important for sustaining all of construction activities (CIOB, 2009). Overhead costs such as management fees and inspections are much easier to reduce than materials and labour when project budget is exceeded. They are typically cut in management and project supervision, process controls, quality assurance, testing activities, equipment, facilities, and so on (Kerzner, 2009). Whilst in practice, project overheads increase significantly compared to direct costs (Enshassi *et al.*, 2008), and are extremely important for sustaining construction activities during operations (Assaf *et al.*, 2001).

Management cost and controlling systems introduce two cycles of construction operations, such as cost planning and operating cycles (Kerzner, 2009). Construction

cost plans may stem from the contract price against project performance to be measured. Operating cycles include measuring work authorisation, recording and reporting economic transactions, cost accounting, and management reporting. Cost Management and Controlling Practices (CMCPs) of project overheads are quite challenging to be investigated. The factors for successful cost performance of construction activities are not specifically addressed in relation to the management of project overheads (Jaya *et al.*, 2011a). Therefore, it is important to investigate and create CSFs to improve the CMCPs of project overheads during the construction stage.

The Groups of Critical Success Factors

Important CSFs have been identified from the literature related to issues and challenges of cost management in construction projects. About forty important CSFs would have to be grouped into a limited number or the key area of activities (Jaya *et al.*, 2011b). In the process, important CSFs can be examined through the description of similar/comparable information or simple relationships between them to determine the groups of important CSFs. The CSF approach has provided some advantageous features such as: ensuring a competitive performance of an organisation (Rockart, 1979); satisfying operational management goals (Rockart, 1982); and sharing explicit understanding and necessary actions on managing an organisation's environment (Foster and Rockart, 1989). Project managers should provide constant and careful attention and take appropriate action based on the CSF approach related to construction activities.

The grouping concept can be initiated during initial reviews of the literature through descriptive literature (e.g., Yang *et al.*, 2009). An identical concept was applied by Akintoye (2000) to consider a comparative study for project cost estimating practices of the 84 construction contractors in the UK for grouping 24 relevant factors. These factors are grouped into the seven most important factors made up of several types of relevant factors. Li *et al* (2005) studied the grouping and ranking of the importance of eighteen CSFs into five groups of important CSFs for Public Private Partnerships (PPP) through the Private Finance Initiative (PFI) projects in the UK construction industry. Suganthalakshmi and Mothuvelayuthan (2012) have grouped various CSFs of the Enterprise Resource Planning (ERP) system based on the similarity of information in the literature into four groups of CSFs (i.e., Technological, Organisational, Strategic, and Tactical), and have mapped them into a matrix to determine communal patterns between them.

This section also includes initial findings of grouping the important CSFs based on their similarity of comparable information to describe inherent relationships and potential challenges among them. These groups of CSFs are enumerated and emerging entities are abbreviated by the researcher accordingly, as provided in table 1. The eight groups of CSFs should be considered in order to ensure effective improvement on the CMCPs of project overheads during construction activities. In

this research, the grouping technique is initiated or implemented during the literature review stage.

Methodology

The questionnaire survey was developed in consultation with experts, and administered to collect wider opinions from project professionals in this area. The expert judgements and questionnaire data can therefore be analysed using Analytic Hierarchy Process (AHP) in order to determine the priority of importance of CSFs. The AHP technique is used to organise and analyse complex decision problems and to deal with both the rational and intuitive selection of the best alternatives through several elements of criteria (Saaty and Vargas, 2012). Verbal expressions for making pair wise comparisons would correspond to the absolute number 1 to 9 (Saaty, 2008). The fundamental values of Saaty's nine scales are explained in table 2.

Table 1: The List of Eight Groups of Important CSFs

Groups	Important CSFs	Potential Challenges	References
1	Understanding the Market Condition (MARCON)	Inform actual resource prices to forecast realistic project costs or expenses to avoid financial losses and in turns maintain project benefits including project overheads	Pitcher (2009); Amiel (2011); and Hook (2011)
2	Project Development Focus (DEVFOC)	Consider a development of new commercial projects instead of restoration of artefact buildings to be more attractive projects	Alley (2004); Wates and Cridlan (2009); Musa (2010); and Osborn and Sassoon (2011)
3	Requirement of Investment and Technology (INVTEC)	Represent project's capital intensives that should be given a careful and special attention to increase project savings	Lock (2004); and Walker (2007); Osborn and Sassoon (2011); and Simon (2011); and Threlfall (2012)
4	Mapping local availability of required resources (LOCRES)	Balance surrounding potentials and develop efficient and effective supply chains to reduce operational costs and improve project benefits	Sears <i>et al</i> (2008); Gould and Joyce (2009); Alarcón <i>et al</i> (2009); and Duglase (2012)
5	Managing a company's interest and project benefit (INTBEN)	Provide great opportunities to increase intellectual capitals and tangible assets for construction companies in respect of common legal systems for financial profits	Ostwald (2001); Alarcón <i>et al</i> (2009); and Skadmanis (2009)
6	Managing project complexity and intricate nature (PROCOM)	Provide the real potential challenges of project managers to be faced as well as great opportunities to create efficiency and effectiveness for project savings	McDowel (2008); CIOB (2009); Winch (2009); Gold and Joyce (2009); and Effron and Ort (2010)
7	Improving contractors' role and current practices (ROPRA)	Consider the contractors' responsibility to provide accurate and competitive estimations of project overheads which reflect detailed processes of construction activities	Assaf <i>et al</i> (2001); Enshassi <i>et al</i> (2008); RICS (2009); and CIOB (2009)
8	Requirement for a robust method and tool (METOO)	Imply that project managers should consider appropriate methods, and effective tools and techniques for improving the Cost Management and Controlling Practices (CMCPs) of project overheads	Akintoye and Fitzgerald (2000); Staub-French and Fischer (2002); Fortune (2006); Heitger (2007); and Jaya <i>et al</i> (2011b)

In order to establish AHP, the problem or objectives should be decomposed into the hierarchical level of goal, criteria, and alternatives (Saaty, 1977; and Haas and Meixner, 2005). This research utilises AHP techniques for synthesising the relations inherent between CSFs-alternatives in respect of each element of Evaluation-criteria, to determine the most important CSFs as a Decision-goal (refer to figure 1). Three levels of AHP are developed to analyse the priority of importance of the CSF-alternatives. There are three parameters structured in this AHP technique:

- The top level of hierarchy is a Decision-goal which represents one of the research objectives to be achieved through the AHP process (i.e. the most important CSFs).
- The middle level involves four elements of Evaluation-criteria; (1) project focus to commercial building types, (2) project construction phase, (3) project monitoring the status of project process and cost performance, and (4) project delivery methods.
- The lower level specifies the analysis of CSF-alternatives in respect of each element of Evaluation-criteria in the above level. Section 4 discusses detailed descriptions of these eight groups of important CSFs which include: (1) MARCON, (2) DEVFOC, (3) INVTEC, (4) LOCRES, (5) INTBEN, (6) PROCOM, (7) ROPRAC, and (8) METOOL.

Table 2: The Fundamental of Saaty's Absolute Numbers

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities equally contribute to the objective
2	Weak or slight	
3	Moderate Importance	Experience and judgement slightly favour one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favour one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favoured very strongly over another; it is dominance demonstrated in practice
8	Very, very strong	
9	Extreme importance	The evidence favouring one activity over another is of the highest possible order of affirmation
Reciprocals of above	If activity i has one of the above nonzero numbers assign to it when compare to activity j , then j has the reciprocal value when compared with i	A reasonable assumption
1.1 to 1.9	If the activities are very close	May be difficult to assign the best value but when compared with other contrasting activities the size of the small numbers would not too noticeable, yet they can still indicate the relative importance of the activities.

Source: Derived from Saaty 2008.

This AHP process starts with analysing the Evaluation-criteria by comparing every pair-wise of its elements. These comparisons are based on an initial consensus of five experts to develop the questionnaire among them, and continued with their personal judgments to score the questions. This questionnaire asks the experts about the degree of importance of forty variable CSFs related to four Evaluation-criteria of construction projects. Personal identification of the experts is abbreviated for ethical purposes. They have graduated with university degrees, and are currently employed in construction companies with the certified ISO-9000: year 2000 or 2008, as explained in table 3.

The questionnaire is assessed in five Likert scales: the smallest unit (1) indicates '*not important*', (2) '*merely important*', (3) '*moderate*', (4) '*mostly important*', and the highest (5) indicates '*highly important*'. It was recognised that the Likert scale is not the exact or precise measurement on particular elements of the Evaluation-criteria for validating their comparisons as explained in table 1, but it represents a relative importance of verbal values of personal judgements attached to the factors in respect of the Evaluation-criteria.

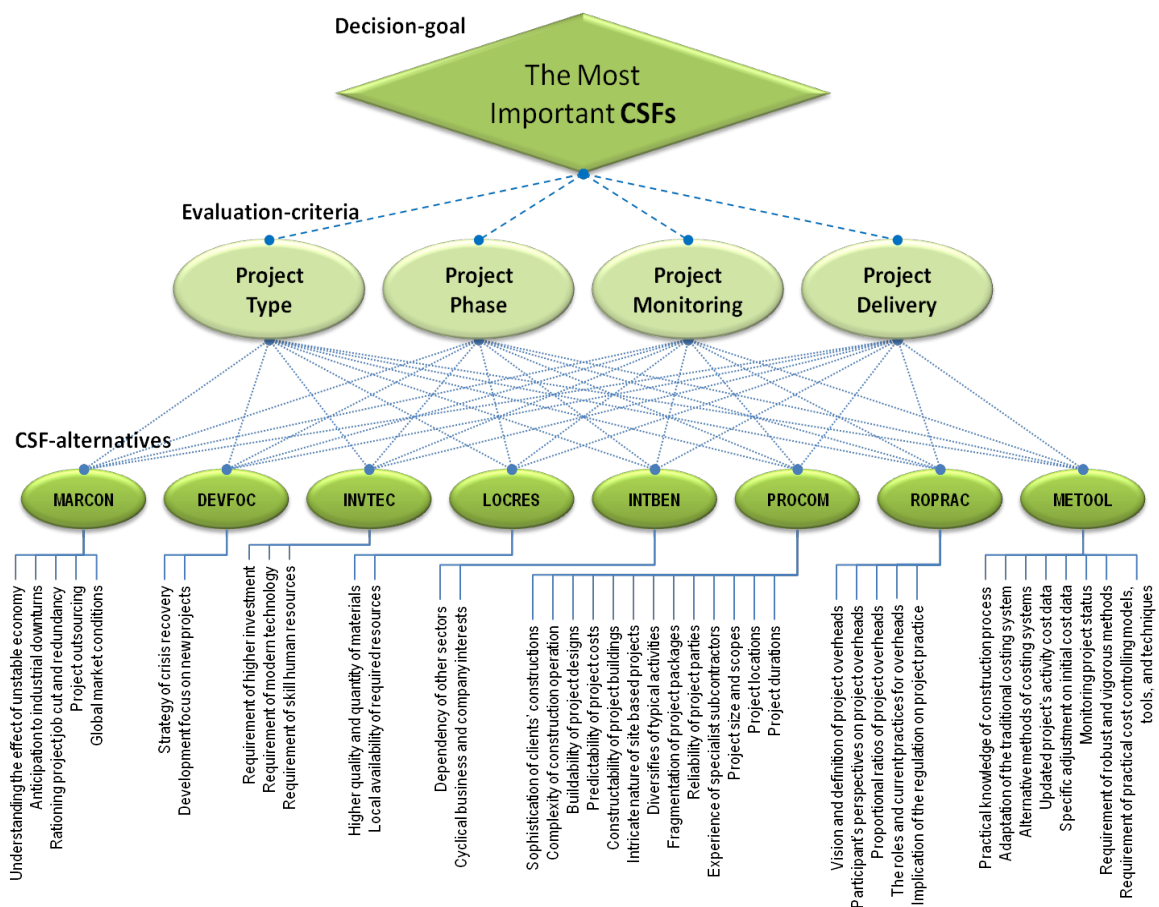


Figure 1: The Decision Structures of Analytic Hierarchy Process (AHP)

Table 3: The List of Experts

No.	Name	Project related	Current Job Title	Overall Experience	Recent Job Experience
1	Mr. AS	All projects	President Director	22	1
2	Mr. BK	All projects	Operational Manager	21	10
3	Mrs. CM	All projects	Finance Manager	20	3
4	Mr. DS	Head Office	Project Manager	20	12
5	Mr. ER	Hotel projects	Chief Engineering	18	8

The survey questionnaire was also given to 250 professionals in the area of cost management and controlling practices, with 107 responses. It was suggested that at least 100 responses of usable data sets are considered sufficient to be analysed (Fellows and Liu, 2008). The response rate of 42.8% should be considered as acceptable enough for analysing data. This data analysis considers the weights of related factors which include forty variables attached in eight groups of CSF-alternatives under four elements of Evaluation-criteria (refer to figure 1). These would enable the measurement of an inconsistency of pair-wise comparison matrices within elements of Evaluation-criteria and factors of CSF-alternatives without destroying their particular roles. However, AHP techniques tolerate the inconsistency up to 10% (Saaty, 1977). As a consequence, the element of criteria or the factor of alternatives compared would be limited to small numbers, up to nine units (Saaty, 2008; and Saaty and Vargas, 2012).

Analysis of Critical Success Factors

Determining Relative Importance of the Evaluation-criteria

A relative importance of each element of Evaluation-criteria over another (refer to middle level of figure 1) is analysed in respect of the Decision-goal as shown on the top level of figure 1. It can be expressed by examining pair-wise comparisons through creating the matrix algebra, and squaring the matrix with multiple iterations until the normalised eigenvector does not change too much compared to the preceding iteration. Prescribed measures are placed in four digit decimals of change values between consecutive iterated matrices (e.g., Haas and Meixner, 2005; and Hamdeh, 2010). However, greater decimals would provide more precise calculations for better results.

Pair-wise Comparisons of the Evaluation-criteria

The dimension of pair-wise comparisons is calculated by given equation (1). The eigenvalue methods (equation 2) and its reciprocal values are used to form the matrix (*A*) through comparing each element of Evaluation-criteria (e.g., Project Type, Project Phase, Project Monitoring, and Project Delivery). Following the matrix formula (equation 3), it is decomposed the matrix algebra in table 4.

$$\text{Number of Comparisons (NoC)} = \frac{n \times (n-1)}{2}$$

Equation (1)

$$\text{Eigenvalue method: } (A - \lambda_{max} n) \times W = 0$$

Equation (2)

Matrix formula:
Equation (3)

$$A = \begin{pmatrix} \frac{w_1}{w_1} & \frac{w_1}{w_2} & \dots & \frac{w_1}{wn} \\ \frac{w_2}{w_1} & \frac{w_2}{w_2} & \dots & \frac{w_2}{wn} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{wn}{w_1} & \frac{wn}{w_2} & \dots & \frac{wn}{wn} \end{pmatrix}$$

Where,

- n : Dimension of matrix (A).
- A : Pair-wise comparison matrix (A).
- λ_{max} : Principal eigenvalue of matrix (A).
- W : Relative weights (eigenvectors) of matrix (A).
- w_1, w_2, \dots and wn : The weights of element 1, 2, ..., and n .

The NoC and eigenvalue are calculated using equation (1) and (2) to decompose the matrix algebra (A) as explained in the example below:

$$NoC = \frac{n \times (n-1)}{2} = \frac{4 \times (4-1)}{2} = 6$$

$$\frac{w_1}{w_2} = \frac{725}{778} = 0.931877$$

Where,

- $NoC = 6$: The 6 sets of pair-wise comparisons are located on the top-right side of diagonal matrix (A) and its reciprocals placed on bottom-left side.
- $w_1 = 725$: The weight of element number 1 (Project Type).
- $w_2 = 778$: The weight of element number 2 (Project Phase).
- 0.931877 : The eigenvalue of Project Type relative to Project Phase, included in the matrix algebra.

The eigenvalues (e.g., 0.91877, 0.834292, etc.) and their reciprocals (1.073103, 1.198621, etc.) of each element relative to other elements are represented in table 4.

Eigenvector Solution of the Evaluation-criteria

The process of AHP techniques must be iterated properly in order to achieve the best result on the eigenvector solution. The following matrices in table 5 and table 6 have

been squared and iterated, and normalised eigenvectors are calculated by dividing each row sum with the total column sum.

Table 4: Matrix Algebra of the Evaluation-criteria

Criteria	Types	Phases	Monitors	Deliveries
Types	1	0.931877	0.834292	1.186579
Phases	1.073103	1	0.895282	1.273322
Monitors	1.198621	1.116967	1	1.422259
Deliveries	0.842759	0.785347	0.703107	1
Column Sum	4.114483	3.834190	3.432681	4.882160

Table 5: First Iteration of Squared Matrices of the Evaluation-criteria

Criteria	Types	Phases	Monitors	Deliveries	Row Sum	Eigenvector
Types	4	3.727506	3.337169	4.746318	15.810993	0.243044
Phases	4.292414	4	3.581128	5.093290	16.966831	0.260811
Monitors	4.794483	4.467866	4	5.689034	18.951383	0.291317
Deliveries	3.371034	3.141388	2.812428	4	13.324851	0.204827
Column Sum	16.457931	15.336761	13.730725	19.528642	65.054059	1

The normalised eigenvector summation for all elements of Evaluation-criteria (Project Type, Project Phase, Project Monitoring, and Project Delivery) should always be an absolute value of '*one*', e.g., as shown in table 5 and table 6. There is not a different value between each normalised eigenvector in the first iteration matrix and the second iteration matrix as shown in table 5 and table 6. It means that the last iteration matrix has provided the best result for the eigenvector solution. The best eigenvector solution in table 6 represents the relative importance of the Evaluation-criteria, and among them can be ranked here:

- Project status monitoring (29.13%) is the most important of the Evaluation-criteria.
- Project construction phase (26.08%) is the second most important.
- Project commercial building type (24.30%) is the third important.
- Project delivery method (20.48%) is the fourth or least important.

Table 6: Second Iteration of Squared Matrices of the Evaluation-criteria

Criteria	Types	Phases	Monitors	Deliveries	Row Sum	Eigenvector	Changes	Ranking Importance of Criteria
Types	64	59.640103	53.394707	75.941080	252.975890	0.243044	← 0.00	The 3 rd important criterion
Phases	68.678621	64	57.298044	81.492635	271.469299	0.260811	← 0.00	The 2 nd important criterion
Monitors	76.711724	71.485861	64	91.024550	303.222135	0.291317	← 0.00	The 1 st important criterion
Deliveries	53.936552	50.262211	44.998849	64	213.197612	0.204827	← 0.00	The 4 th important criterion
Column Sum	263.326897	245.388175	219.691600	312.458265	1,040.864936	1	0.00	

Consistency of the Evaluation-criteria

The level of inconsistency must be checked to ensure whether the result on the relative importance of Evaluation-criteria is derived from acceptable consistent matrices. If the result is considered to be robust enough and makes sense, it should be obtained from consistent or near consistent matrices (Ishizaka and Labib, 2009). The principal eigenvalue is necessary for examining the level of inconsistency of the matrix (Saaty, 2008). Therefore, Saaty (1977) has calculated the Consistency Index (*CI*) and Consistency Ratio (*CR*) using given equation (4) and equation (5) below:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Equation (4)

$$CR = \frac{CI}{RI}$$

Equation (5)

Where,

$CR < 10\%$: Consistency Ratio less than 10% (an acceptable inconsistency of the matrices).

RI : Random Index.

The average random index was randomly generated reciprocals through analysing sample size of 500 matrices (Ishizaka and Labib, 2009), and provided in table 7. The consistency ratio has been calculated following this procedure with given $n=4$ units and $RI=0.90$, resulting in $CR \sim 0.00 < 10\%$. This indicates that the matrices examined are *near perfectly consistent*.

Table 7: Random Inconsistency Index

n	1	2	3	4	5	6	7	8	9	10	11
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.49

Source: Adapted from Saaty (1997)

Determining Relative Importance of the CSFs-alternatives

Following a similar AHP procedure to that of section 5.1, the relative importance of the CSF-alternatives is analysed in respect of the four elements of the Evaluation-criteria (Project Type, Project Phase, Project Monitoring, and Project Delivery) as shown in figure 1. For a calculation example, the relative importance of CSF-alternatives under the Project Type can be expressed by examining pair-wise comparisons through matrix algebra as provided in table 8. A normalised eigenvector of the iteration matrices can be obtained through squaring the matrices that are calculated in table 9 and table 10. These matrices are measured in six digit decimals. Normalised eigenvectors between table 9 and table 10 have shown insignificant changes. The highest change is represented by PROCOM (=0.0005297). Actually, an attempt to iterate one more squared matrix would have not change the ranking of normalised eigenvectors. This eigenvector may be called the best eigenvector solution (refer to table 10). The consistency ratio for this matrix has been checked following procedures as presented in equations (4) and equation (5), given $n=8$ units, with $RI=1.41$ (refer to table 7). The result shows that $CR = 0.019 < 10\%$. This indicates that the matrices examined are *nearly consistent*. The relative importance of CSF-alternatives under the other three Evaluation-criteria (i.e., Project Phase, Project Monitoring, and Project Delivery) have been analysed through the same procedures as applied for CSF-alternatives under the Project Types. The best eigenvector solutions of Evaluation-criteria derived from table 6, and all of the best eigenvector solutions of CSF-alternatives are restructured to develop an AHP solution tree.

Table 8: Matrix Algebra of CSFs-alternatives under the Project Type

Alternatives	MARCON	DEVFOC	INVTEC	LOCRES	INTBEN	PROCOM	ROPAC	METOOL	Row Sum
MARCON	1	1.213592	1.30813953	1.322751	1.470588	1.12069	1.227094	0.953895	9.61675
DEVFOC	0.824	1	1.07790698	1.089947	1.211765	0.923448	1.011126	0.78601	7.924202
INVTEC	0.764444	0.927724	1	1.01117	1.124183	0.856705	0.938045	0.7292	7.351471
LOCRES	0.756	0.917476	0.98895349	1	1.111765	0.847241	0.927683	0.721145	7.270263
INTBEN	0.68	0.825243	0.88953488	0.899471	1	0.762069	0.834424	0.648649	6.53939
PROCOM	0.892308	1.082898	1.16726297	1.180301	1.312217	1	1.094946	0.851168	8.5811
ROPAC	0.814933	0.988997	1.06604651	1.077954	1.198431	0.913287	1	0.777361	7.83701
METOOL	1.048333	1.272249	1.37136628	1.386684	1.541667	1.174856	1.286404	1	10.08156
Column Sum	6.780019	8.228178	8.86921064	8.968279	9.970616	7.598297	8.319722	6.467427	65.20175

Table 9: First Iteration of Squared Matrices of CSFs-alternatives under the Project Type

Alternatives	MARCON	DEVFOC	INVTEC	LOCRES	INTBEN	PROCOM	ROPAC	METOOL	Row Sum	Eigenvector
MARCON	8	9.708738	10.4651163	10.58201	11.76471	8.965517	9.816754	7.631161	76.934	0.14797563
DEVFOC	5.768	8	8.62325581	8.719577	9.694118	7.387586	8.089005	6.288076	62.56962	0.120347
INVTEC	6.115556	7.421791	8	8.089359	8.993464	6.85364	6.508201	5.833598	57.81561	0.111203
LOCRES	6.048	7.339806	7.91162791	8	8.894118	6.777931	7.421466	5.769157	58.16211	0.11186958
INTBEN	5.44	6.601942	7.11627907	7.195767	8	6.096552	6.675393	5.189189	52.31512	0.10062343
PROCOM	7.138462	8.663181	9.33810376	10.49996	10.49774	8	7.76858	6.809343	68.71537	0.13216782
ROPAC	6.519467	7.911974	8.52837209	8.623633	9.587451	7.306299	8	6.268455	62.74565	0.12068561
METOOL	8.386667	10.17799	10.9709302	11.09347	12.33333	9.398851	10.29123	8	80.65248	0.15512778
Column Sum	53.41615	65.82543	70.9536852	72.80378	79.76493	60.78638	64.57063	51.78898	519.91	1

Table 10: Second Iteration of Squared Matrices of CSFs-alternatives under the Project Type

Alternatives	MARCON	DEVFOC	INVTEC	LOCRES	INTBEN	PROCOM	ROPAC	METOOL	Row Sum	Eigenvector	Changes
MARCON	504	621.3592	669.767442	686.7302	752.9412	573.7931	608.9626	488.8809	4906.43	0.1481122	-0.0001366
DEVFOC	408.704	504	543.265116	557.1461	610.7294	465.4179	493.6962	396.5498	3979.51	0.1201308	0.0002163
INVTEC	378.7856	467.113	503.5044	516.3765	566.031	431.3547	457.5488	367.4779	3688.19	0.1113367	-0.0001336
LOCRES	381.024	469.7476	506.344186	519.168	569.2235	433.7876	460.3757	369.5939	3709.26	0.1119728	-0.0001032
INTBEN	342.72	422.5243	455.44186	466.9765	512	390.1793	414.0946	332.439	3336.38	0.1007163	-0.0000929
PROCOM	449.6584	554.3652	597.554099	612.6891	671.7602	511.9276	526.6293	436.1214	4360.71	0.1316381	0.0005297
ROPAC	411.1421	506.8708	546.359623	560.1892	614.2082	468.069	496.774	398.8019	4002.41	0.1208222	-0.0001366
METOOL	528.36	651.3916	702.139535	719.9221	789.3333	601.5264	638.3958	512.5101	5143.58	0.1552709	-0.0001432
Column Sum	3404	4197.372	4524.37622	4639.198	5086.227	3876.056	4096.477	3302.375	33126.47	1	0.0000000

The Solution through AHP Tree

Relative weights of the best eigenvector solutions are attached in each related element of Evaluation-criteria and each related factor of CSFs-alternatives accordingly, as illustrated in figure 2. It would appear in the AHP solution tree that every factor of CSF-alternatives is related to the relative importance of the individual element of Evaluation-criteria. Therefore, in order to select the highest priority of important CSFs among the eight CSF-alternatives, their individual weights should be decomposed into the AHP solution matrix in table 11. Table 11 represents two adjacent matrices. The left-side matrix is relative weights of CSFs-alternatives and the right-side is relative weights of Evaluation-criteria. Every row of the left-side matrices is multiplied by the related column matrices in the right-side of table 11 to obtain the ranking importance of CSF-alternatives as shown in table 12.

Table 11: AHP Solution Matrix of CSFs-Alternatives under Evaluation-criteria

ALTERNATIVE	Type	Phase	Monitoring	Delivery
MARCON	0.148112189	0.147208722	0.145532894	0.149111634
DEVFOC	0.120130759	0.120809419	0.121197368	0.120710711
INVTEC	0.111336686	0.109605596	0.11438665	0.108990986
LOCRES	0.111972815	0.111920442	0.112676949	0.108440793
INTBEN	0.100716288	0.103449812	0.107288051	0.099792141
PROCOM	0.131638076	0.130399126	0.129120952	0.129147904
ROPAC	0.120822242	0.121657447	0.120214404	0.121421841
METOOL	0.155270945	0.154949436	0.149582732	0.162383989
Column Sum	1	1	1	1

RANKING	CRITERIA
0.243043916	Type
0.260811264	Phase
0.291317466	Monitoring
0.204827355	Delivery
100%	

X

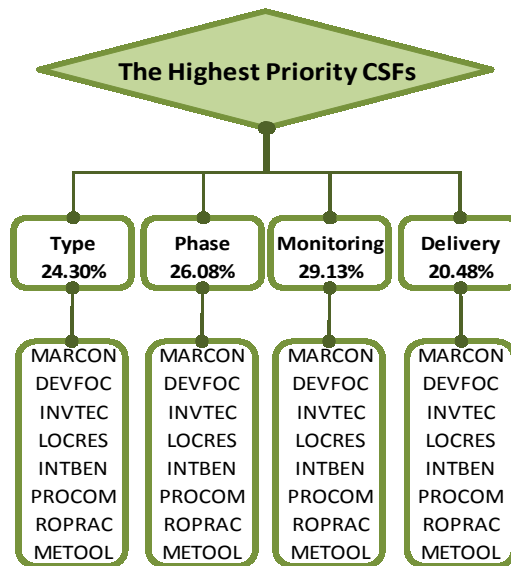


Figure 2: AHP Solution Tree of CSF-alternatives under Evaluation-criteria

MARCON	0.147329875	2nd	CSFs	1	Order	Difference
DEVFOC	0.120737273	5th	METOOL	0.154986962	1st	
INVTEC	0.111293243	7th	MARCON	0.147329875	2nd	0.0076570
LOCRES	0.111440827	6th	PROCOM	0.130071606	3rd	0.0172582
INTBEN	0.103154401	8th	ROPAC	0.120985813	4th	0.0090857
PROCOM	0.130071606	3rd	DEVFOC	0.120737273	5th	0.0002485
ROPAC	0.120985813	4th	LOCRES	0.111440827	6th	0.0092964
METOOL	0.154986962	1st	INVTEC	0.111293243	7th	0.0001475
CSFs	1	Ranking	INTBEN	0.103154401	8th	0.0081388

Table 12: Ranking of Importance of CSF-alternatives

Table 13 represents descending orders of CSF-alternatives to identify their priority of importance.

The priority of importance of the CSF-alternatives selected should be greater than the assumption of its' average weights. The average weight of the eight CSF-alternatives is calculated through the total percentage weight divided by the number of alternatives, as $\frac{100\%}{8} = 12.50\%$. Therefore, based on this assumption, the three

priorities of the CSF-alternatives are identified as having greater weights than 12.50%, they are: METOOL=15.50%, MARCON=14.73%, and PROCOM=13.01% (refer to table 13).

Findings and Discussion

Academic and professional research normally involves two important activities, such as a literature review and a field survey. A literature review is the requirement to make judgements related to both the value of all of the references and organising ideas and findings (Saunders, *et al.*, 2009). A field survey is the essential procedure to collect data from individuals and institutions that have no controls, sanctions, and structured limitations of a survey questionnaire (Yin, 2009). It would be possible to derive research findings from both data sources, such as literature and questionnaires. This section discusses the survey questionnaire category of the research findings.

Discussion on Survey Findings

Individual judgements of five experts are considered to determine the relative importance of the Evaluation-criteria. Accumulated scores of forty variable CSFs are weighted to every element of Evaluation-criteria. The weights of each element of four Evaluation-criteria are used to develop matrix algebra through pair-wise comparisons. This matrix algebra has been squared and iterated twice until the last normalised eigenvectors have little or no change values compared to the previous iteration. This normalised eigenvectors could be said to be the best eigenvector solution. In addition, the consistency has been checked, and the result of $CR \sim 0.00\% < 10\%$ indicates that the individual judgements of the experts on comparing elements of the Evaluation-criteria are considered to be near perfectly consistent. The relative influence of every element of the Evaluation-criteria to the CSFs-alternatives in respect of Decision-goal (the best priority of importance of CSFs) can therefore be discussed here, refer to table 6. *Project status monitoring* for updating project process and cost performance gives a relative influence of 29.13% (greater than average weight of $\frac{100\%}{4} = 25\%$).

Project construction phases on mobilisation of project resources and construction to practical completion represents a relative influence of 26.08%, which is also greater than 25%. These two elements of Evaluation-criteria provide major effects to the eight CSF-alternatives. *Project commercial building types* with relative influence of 24.30% and *project delivery methods* with 20.48% provide less effectiveness than the average weight. However, all four elements of the Evaluation-criteria and the eight CSF-alternatives are considered to have important interdependency in order to determine the best priority of importance of CSF-alternatives.

Moreover, consistency ratios of matrices of CSF-alternatives under Evaluation-criteria were found very close to zero. The CSF-alternatives under the Project Type are represented by $CR = 0.019 < 10\%$; Project Phase $CR = 0.021 < 10\%$; Project Monitoring $CR = 0.014 < 10\%$; and Project Delivery $CR = 0.022 < 10\%$. These consistency ratios may indicate that the survey questionnaire was designed to observe

several factors of CSF-alternatives using large numbers of variables to collect redundant information, and consequently, more responses with detailed and actual weights are received. The ranking of eigenvector solutions in table 11 would seem to be complicated and slightly different between each one. The ranking importance of CSF-alternatives under Project Type and Project Phase is different to the ranking of Project Monitoring and Project Delivery. For example: DEVFOC is temporarily positioned at 5th ranking under Project Type and project Phase, while at 4th ranking under Project Monitoring and 5th under Project Delivery. INVTEC is placed at 7th ranking under Project Type and Project Phase, while at 6th under Project Monitoring and Project Delivery, and so on. This complex multi-criteria decision making would be resolved through the AHP solution tree (refer to figure 2). Individual weights of the best eigenvector solutions for both CSF-alternatives and Evaluation-criteria are decomposed into adjacent matrices (table 11). Multiplying each row matrix of CSF-alternatives with the column matrix of Evaluation-criteria would result the ranking of importance of CSF-alternatives (table 12). Using the assumption of average weight principles we can select the best priority importance of CSFs. In this research, after considering Evaluation-criteria and measuring the ranking of importance of CSF-alternative by an average weight of 12.50% (refer to section 5.3) we can identify the three highest priorities of important CSFs (table 13). Therefore, the best three out of eight important CSFs that could provide the most improvement to the CMCPs of project overheads are:

- (1). The requirement for a robust method and tool - *METOO*L implies that project managers substantially considered the availability of appropriate methods, effective tools and techniques to help for better CMCPs of project overheads.
- (2). Understanding the market condition - *MARCON* will inform the actual resource prices to forecast realistic project costs or expenses to avoid financial losses and in turns maintain project benefits including project overheads.
- (3). Managing project complexity and intricate nature - *PROCOM* provides the real potential challenges to be faced by project managers, as well as great opportunities to create competency and effective CMCPs of project overheads.

Conclusion and Recommendation

Construction projects would inevitably require project overheads for sustaining whole construction activities. Project overheads are expected to be slightly higher in real projects than it is reported in the literature. Successful CMCPs of project overheads are very much dependant on the implementation of critical factors, such as: the robust methods, tools and techniques; the regional and global economy of market conditions; the intricate nature of project complexities; and other CSFs. The literature review identifies forty important CSFs to develop a survey questionnaire through providing consensus with experts. Four Evaluation-criteria (e.g., Project types, phases, monitoring, and delivery) were included to collect detailed responses and actual weights of information from project professionals. The concept of grouping CSFs involved identifying similarity of information and relationships inherent among them. The resultant eight groups of important CSFs include: MARCON, DEVFOC,

INVTEC, LOCRES, INTBEN, PROCOM, ROPRAC, and METOOL. This research revealed that the relative importance of CSF-alternatives can be analysed through the application of Analytic Hierarchy Process (AHP) in respect of Evaluation-criteria for the Decision-goal. Therefore, the best three out of eight important CSFs are METOOL, MARCON, and PROCOM, and these would provide the most effective improvement to the Cost Management and Controlling Practices (CMCPs) of project overheads during the construction stage.

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Design and Build Procurement Method in Practice: Exploration of Experiences of Key Participants in the UK Construction Industry

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Abstract

Over the recent years the UK construction industry has seen an increasing level of interest in the use of design and build (D&B) as a construction procurement method. This appears to be mainly driven by an attempt to increase the level of integration in what is generally viewed as a fragmented industry. The main advantages associated with this procurement method that have been cited in literature are single point responsibility, early contractor involvement resulting in potential cost savings and earlier completion and easy constructability and minimisation of design and construction risk to clients. The output of this research is a framework for facilitating effective and efficient implementation of the D&B procurement method. The paper is based on a combination of an in-depth literature review as well as semi-structured interviews with key participants undertaken in order to gain rich insights into their experiences of the D&B procurement method. In addition as part of continuation of this research a web based questionnaire targeting UK construction clients, contractors and consultants would be used to gather additional data from a wider audience on how the procurement system is being put in practice in the wider UK construction industry.

Keywords

Design and Build; Framework; Procurement method; UK Construction Industry

1. Introduction

Despite the significance and benefits attributable to integrating design and construction within construction procurement systems it would appear from literature reviewed that there are a host of underlying constraints that have been reported to be affecting design and build (D&B) procurement as a construction project delivery method. This could be viewed by some as ironic given that D&B procurement method has been, and is still, perceived to have addressed the problem emanating from the fragmentation of the construction delivery process. Current body of knowledge that has been reviewed brought to light some significant D&B procurement issues that have been encountered by key participants (identified in this paper as designers, clients and contractors) of the industry. For instance Fahmy and Jergeas (2004) highlighted the difficulty that construction clients face in defining requirements clearly and still leave some room for creativity and ingenuity for the D&B contractor.

Similarly Bennett *et al.* (1996) reported that there is a perceived inferiority in terms of the quality of the construction product coming out of the D&B procured project. Cecil (1983) also observed in his research the perception by some clients who felt that by

adopting D&B as a procurement route for their projects they tend to lose control of the design and construction processes which they thought may be taken advantage of by some D&B contractors. In support of this perception such clients bemoaned the fact that there is no overall design and construction supervision from the owner when utilising a typical D&B procurement method to deliver construction work.

Although the current body of literature provides an extensive coverage of the constraints perceived to be encountered using D&B procurement method it would appear that previous researchers reviewed tended to focus more on constraints encountered by construction clients with less coverage and/or focus on other key participants involved in D&B procurement such as designers and contractors. It is therefore argued in this paper that any attempt to understand such a complex phenomenon should encompass a holistic analysis of experiences from other key participants involved such as designers and D&B contractors. Focusing on construction clients only will provide a partial picture of this multifaceted problem. The paper therefore explores this problem from a holistic perspective that covers not only construction clients but construction designers and D&B contractors as well. Such a multifaceted approach, it is further argued, could lead to the unraveling of not only other significant constraints but some significant good practice that could assist in future development of a framework that can be used as guidance and/or tool kit for the benefit of all users of this integrated construction method.

2. Research Methodology

The paper's focus on the D&B procurement method and the examination of complex constraints concerning people (key participants involved in D&B procurement), organizations (clients, contractors and designers), construction processes (principally design and construction), situations and ordinary events in their natural settings dictates that the study is of an exploratory nature. As highlighted by Robson (2002) such exploratory type studies are characterized by a quest to have a deeper insight in little understood situations; seeking new insights of phenomena; asking questions in order to assess phenomena in a new light and to generate ideas and hypotheses for future research. The nature of the problem under investigation therefore demands both a detailed understanding through a qualitative exploration of the constraints as well as a more general understanding of the constraints through a quantitative exploration of the constraints generated by an in-depth understanding of the constraints from the qualitative research. This therefore demands the use of the mixed methods approach in order to accomplish an exhaustive exploration of the problem. The paper, however, only covers the first phase of the research undertaken to date.

The qualitative phase, in addition to providing an in-depth understanding of the problem, highlights the complex attributes of the problem which would then be tested by the quantitative phase in order to identify whether qualitative results can be generalized. An exploratory mixed methods sequential design has thus been adopted as a methodological vehicle to accomplish the goal of this research.

2.1 Review of related Literature

2.1.1 Single point responsibility

Single point responsibility has been cited as one of the key attributes and perceived advantages of the D&B procurement method. As Twomey (1989) observed the single point responsibility notion comes from the observation that, with this method of project delivery, the construction client enters into contract with a single organization that provides the client with all of the services necessary to both design and construct all or portions of the project. Follow on benefits flowing from this have been cited as better coordination between design and construction activities, elimination of second hand information, elimination of the 'blame culture' that has been associated with the traditional design-led fragmented procurement method, early involvement of sub-contractors and suppliers, one simpler contractual relationship with one D&B contracting organization which means errors/omissions in design are not the client's responsibility. However such benefits and perceived advantages linked with single point responsibility have been challenged in the reviewed literature with some researchers coming up with a host of arguments with some appearing to purport that single point responsibility can be disadvantageous to clients.

One such concern has been highlighted by Lee et al., (2009) who opined that single point responsibility is only advantageous when the client's administration of the quality performance of the D&B contractor is assured and secured. How this quality performance can be assured and secured in practice has not been well covered and elucidated. Elsewhere Fahmy and Jergeas (2004) went further to provide further arguments on how such single point responsibility can impact on the client's ability to effectively administer the quality performance of the single D&B organization. They opined that since clients lose the direct control over the design and the fact that the designer is accountable to the D&B contractor design decisions usually are inappropriately influenced by the D&B contractor, who in most cases, they went on to opine, may pressure the designers to reduce quality criteria or design standards to minimum levels in order to maximize profits.

Correspondingly such concerns were echoed by Tietz (1999) when he highlighted that the D&B contractor being the principal agent within D&B procurement and the fact that construction value overshadows design costs the D&B contractor's opinion tends to prevail when quality of design and construction savings come into conflict. This appears to support Lee et al., (2009)'s observations that single point responsibility created by the D&B procurement arrangement is disadvantageous to the client in some respects. Single point responsibility is therefore perceived to bring with it the elimination of third party 'quality control' by the client which is clearly an issue as the party now responsible for completing the construction work as quickly and as 'cheaply' as possible (the D&B contractor) also has control over the passing of the quality and the quantity of the work!

Combining design and construction functions into a single contracting entity is also said to create constraints with clients as they see themselves losing the checks and balances that exist with the traditional design led fragmented procurement method. Similarly McDonough (2002) commented that the quality of the process and of the finished product cannot be guaranteed as the monitoring of quality is not as transparent as it is in the traditional design-led procurement method again in tandem with observations and comments made by Lee *et al.* (2009).

2.1.2 Briefing process

Constraints in connection with single point responsibility brought about by D&B procurement method are mirrored by constraints that have been reported to be affecting clients in determining project requirements to enable D&B contractors to price and come up with proposals that align with client requirements. The briefing process has been described by Kamara and Anumba (2000) as including defining, eliciting, analyzing, translating, organizing and documenting requirements and incorporating them into the project. Requirements, according to Gilb (2005), Zielczynski (2008) and Robertson and Robertson (2005), are reflective of targets, desires, expectations or constraints imposed by clients on the project functionality and quality.

Kamara (1999), in a research in which he carried out an assessment of how the briefing process is carried out in the UK construction industry, observed that although information collected is sometimes documented in formal documents such documents are not normally stored as part of the brief and normally the design organization relies on recollections of verbal communications with the client. Other researchers such as Newman et al., (1981), Goodacre et al., (1982) and Construct IT (1996) similarly came up with observations that mirror Kamara (1999)'s findings. In addition they also came up with additional findings that suggest that the use of the solution (i.e. the design) to clarify the problem can shift focus from client requirements to the preferences of the designer due to the fact that proposed design solutions are usually made before a thorough understanding of the client requirements. It would appear that such findings have led Howie (1996) to comment that due to this underlying issue it is not surprising that many client briefs are generated out of design rather than a clear understanding of the client's actual objectives.

Other researchers such as Bowen *et al.* (1999) observed that oral presentation is the medium by which the brief is most commonly communicated resulting in considerable potential for miscommunication. This observation reflects Kamara (1999)'s findings which also highlighted the preponderance of verbal communications during the briefing process resulting in possible miscommunication. Correspondingly Bowen et al., (1999) also observed that insufficient time is devoted to the briefing process and in some cases they found that briefing is prematurely initiated before alternatives have been analysed. Apart from the communication issues highlighted by Bowen et al., (1999) and Kamara (1999) others such as Arayici et al., (2006), Yu et al., (2005) and Shen and Chung (2006) observed that the briefing process only covered a limited perspective of the proposed construction facility as stakeholders overlooked some vital parts of the building. Similarly professionals and clients were found to seldom perceive the project as a whole at the inception stage, an observation that has also been made by Leite et al., (2005) who also added that this lack of holistic view leads to an underestimation of those critical requirements that appear to be negligible at first glance but of great effect in the future.

In another related research Zielczynski (2008) also confirmed findings from earlier research by his observations in which he stated that the language used and the clarity of client requirements in a brief always frustrate stakeholders causing misunderstanding and misinterpretation.

2.1.3 D&B procurement process related constraints

Employer's requirements are a common term that is used in D&B procurement to describe the construction client's requirements. For the procurement method to work efficiently these requirements are supposed to be well defined and comprehensive as well as articulating the aesthetic and performance criteria that the client require from the finished product (the constructed facility). However there have been reported constraints militating against the smooth operation of this process as highlighted in section 2.1.2 above.

The very issue of producing and defining requirements has been found by Fahmy and Jergeas (2004) to impose problems to clients as it is more labour intensive and technically demanding when compared to the traditional design led fragmented procurement method. This had earlier been echoed by Ndekugri and Church (1996) when they observed that for owners who do not possess any knowledge of the construction industry the D&B procurement route may not be advisable as they would potentially face problems if they are not experienced enough to produce a brief that is clear and comprehensive.

In a similar vein Chan *et al.* (2001) further observed that owners' competencies that affect D&B procurement project success include their capability in managing D&B projects, their understanding of D&B project scope and their ability to clearly articulate end users' requirements. In tandem with this observation Fredrickson (1998) observed that the other issue relating to the D&B tendering process is related to how much information that needs to be provided in order to get bids from D&B contractors. The paradox is said to be centred on the fact that the less information that is provided the more the D&B contractor will have to assume leading to another issue in which the more that each D&B tenderer assumes the less likely that each D&B tender will be similar leading to difficulty in comparing bids in terms of 'best value' and significant differences in quality, operation and maintenance of the proposed construction facility.

On the other hand the more information provided to D&B tenderers the less flexibility the D&B bidders will have to apply their expertise in coming up with 'best value' solutions. In addition, as opined by Fredrickson (1998) there is a risk that if the client requires the entire design development to be completed and included in the bidding documents the D&B contractor might not be considered the designer of record in the event of future problems with the construction facility. The more uncertainty there is in the definition of the work when the price is established the more contingency/risk money is added to the D&B price in order to take into account the unknowns. The less design there is to clearly explain the project the greater this contingency is. Compared to the traditional design led procurement method Nahapiet and Nahapiet (1985) observed that it is more difficult to evaluate D&B tenders because of the need to evaluate both price and design as D&B tenderers offer different systems and services and are perceived to provide limited amount of information for evaluation. The evaluation process demands time and resources of D&B clients hence the comments by Fahmy and Jergeas (2004) that the D&B procurement method is more labour intensive and technically demanding for clients than is required in traditional design led procurement methods.

During the design development stages Preece and Tarawnah (1997) have raised an issue which appears to resonate with earlier comments on design development by

stating that in some projects D&B contracting organizations have failed to provide care and attention to understand client requirements. As a direct consequence of the perceived exclusion of the client from design development discussions Fahmy and Jergeas (2004) opined that communication is sometimes a problem due to the fact that once a D&B contract is awarded clients may be out of the loop and all design and construction decisions and trade offs are internal to the D&B team and do not involve clients.

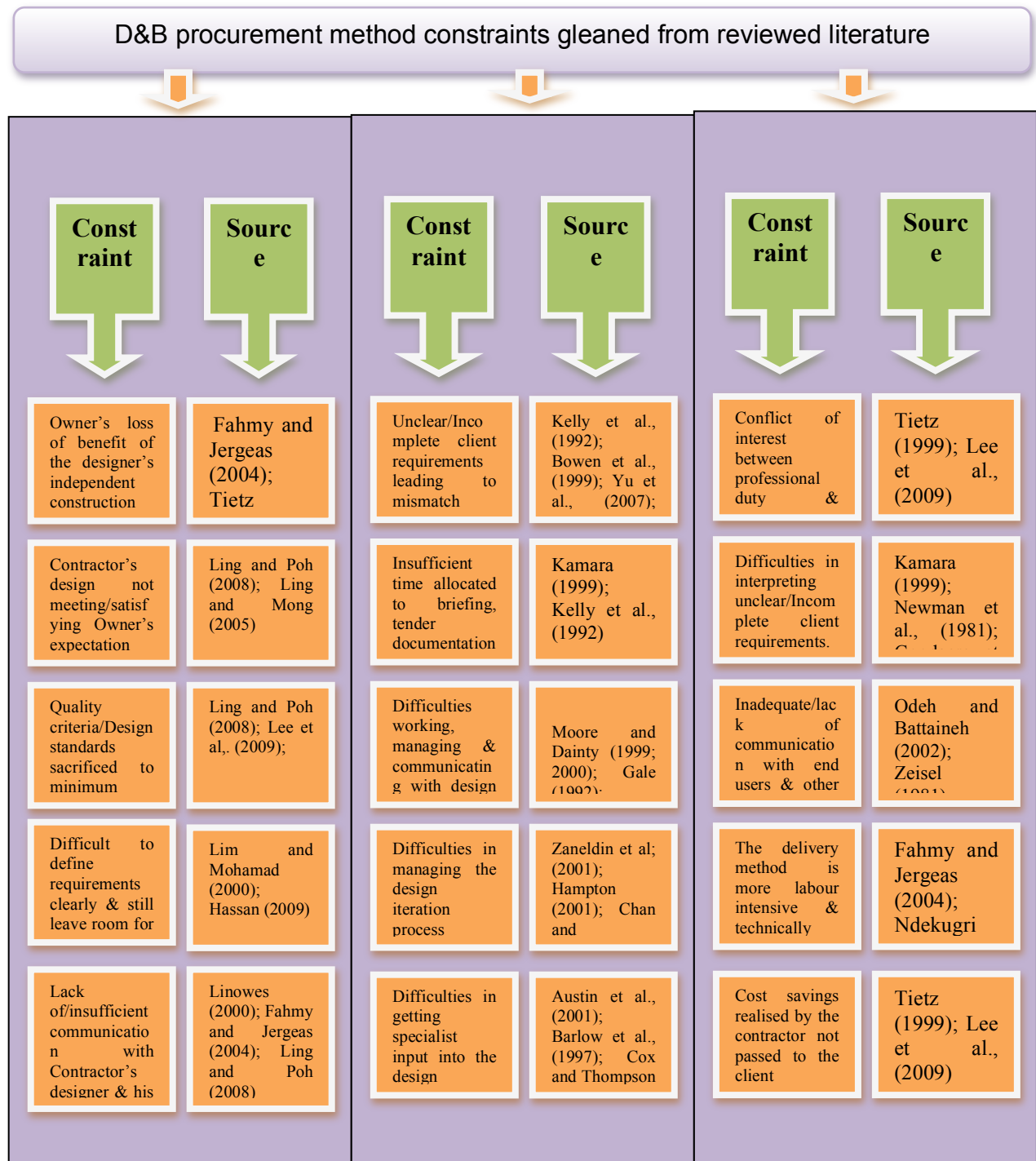


Fig. 1. D&B constraints gleaned from reviewed Literature

Based on the literature reviewed it is evident that although integration of design and construction processes brings with it significant advantages (such as single point responsibility, cost certainty and time savings) to clients of the construction sector there are numerous constraints that have been reported to have hampered the smooth flow of the whole delivery process when D&B procurement is used. Review of related literature highlighted the existence of constraints particularly in connection with the briefing process, the tendering process through to evaluation of tenders, appointment, design development and construction of the project. Figure 1 below summarises findings from reviewed literature on the constraints that participants of the D&B procurement method face when undertaking construction projects procured through the D&B procurement method.

3. Results and Discussion

As part of the exploratory survey several in-depth interviews were undertaken with senior members within the D&B contractor organisations, the designer organisations and client organizations. Organisations that have been actively involved and engaged in delivering construction projects utilising D&B procurement method in the UK over the recent past decades particularly after 1998 when the D&B procurement method has been shown to have been on the increase in terms of usage in the UK construction sector relative to the traditional design-led method of procurement (see Figure 2 below) were targeted interviewees.

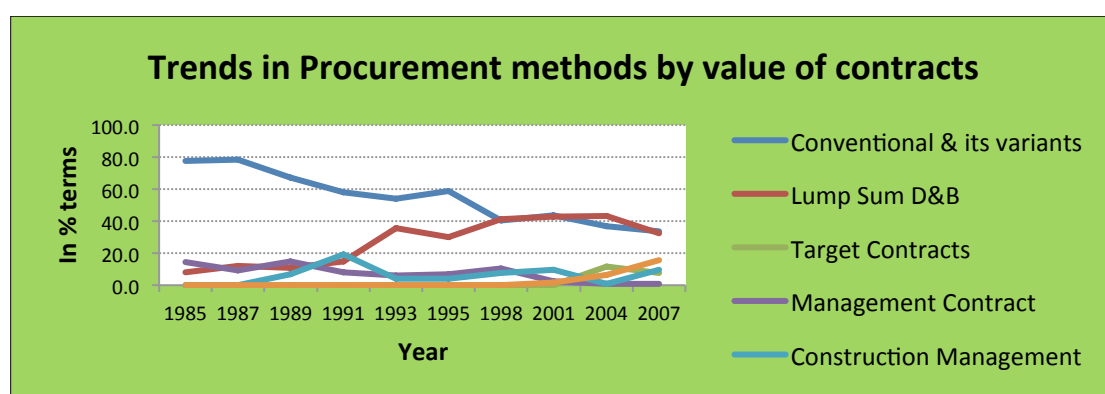


Fig. 2. Trends in procurement methods in the UK by value of contracts: 1985-2007
(Adapted from: The RICS Contracts in use survey (2007))

League tables for clients contractors and design consultants (based on the comprehensive UK construction activity data) produced by the Building magazine and the Construction News (2012) were used to identify the targeted interviewees. In total 15 interviews have been undertaken with designers, contractors and clients and the following Figure 3 shows in tabular format details of the participants interviewed.

Table 1 below summarises the number of years' experience the interviewees have had within the construction industry and the approximate values of projects they have undertaken. Project Managers, Principal Engineers and Contractors' Site Agents have been classified as middle managers, Contracts Managers, Development Managers, Senior Project Managers, Senior Commercial Managers and Senior Design Managers have been classified as top level managers while Directors, Senior Executives and Programme Managers have been classified as strategic level management.

Interviewee member checking of all transcripts was undertaken to ensure validity and reliability of the gathered data. Nvivo 10 content analysis tool was then used to code themes emanating from the interview process and placing them into single nodes (containers). The resultant nodes helped in generating ideas and also helped in identifying patterns and theories discussed in this paper. Themes of similar contexts were grouped into the same tree node structure and a resultant thematic coding framework was identified centering around three main themes viz; negative experiences that participants had with the D&B procurement method, how they dealt with the negative experiences and lastly opportunities for improvement as well as good practice that participants observed from their experience using D&B procurement method. Results from the interviews undertaken are shown in Figure 4 below.

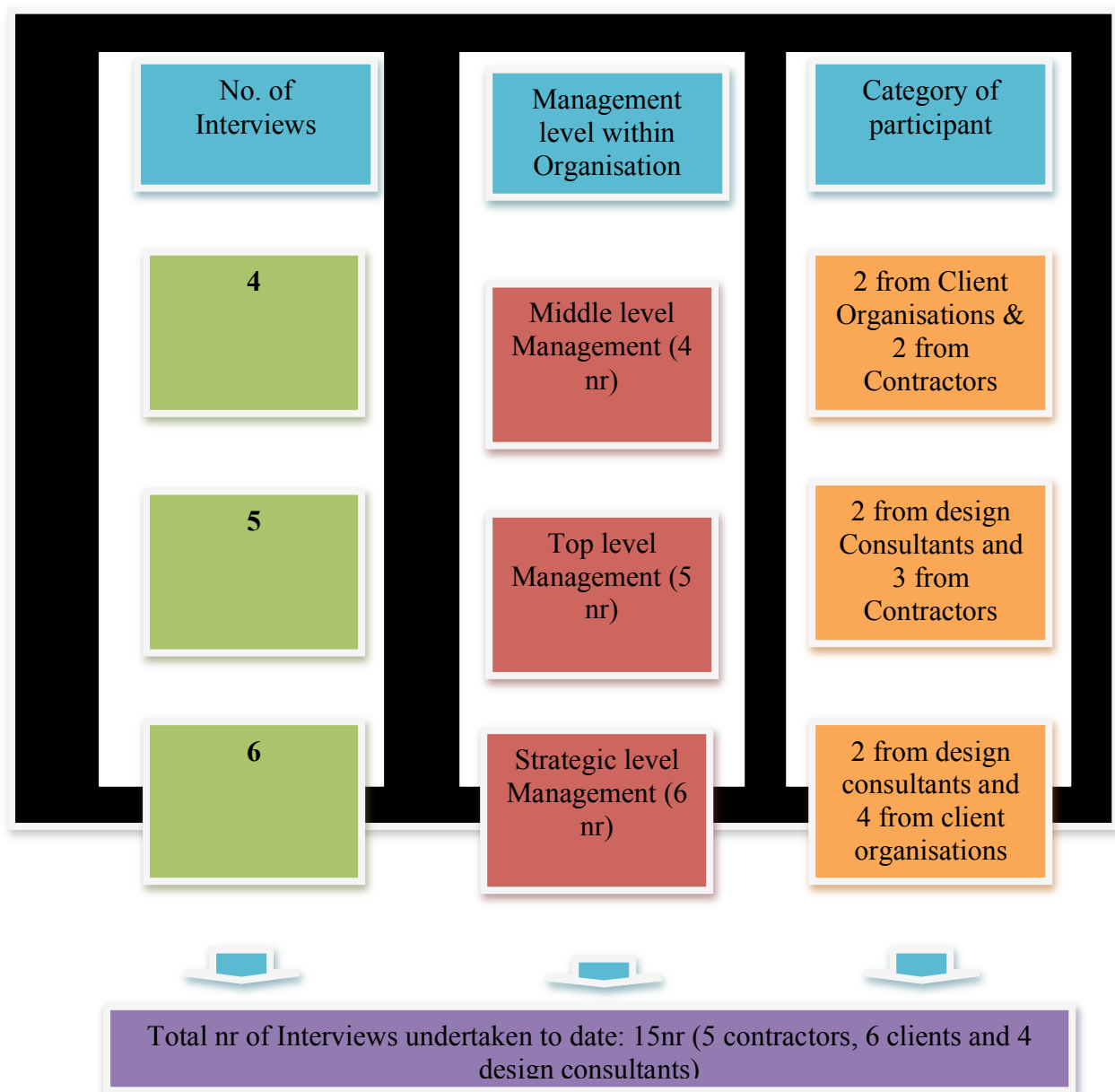


Fig. 3. Interviewees categorisation

Although it may appear as though the experiences encountered by the key participants of the D&B procurement method are different a close examination of the constraints raised show that there are some similarities as well.

For instance it would appear that the inadequacy and insufficiency of the briefing process is felt as a constraint by all key participants interviewed. Due to this constraint the contractor will not be able to correctly interpret, price and deliver the end product required by the client resulting in a mismatch between the Employer's requirements and the Contractor's proposal. When this happens the client is not satisfied with the end product and the contractor may not be able to get repeat business from the dissatisfied client resulting in a lose-lose situation to both participants. Equally the designer (although working for the D&B contractor) would experience frustrations with brief inadequacy and insufficiency as he/she will not be able to adequately resource and price for the required design services. In addition the designer experiences constant frustration during design development as he/she may encounter delays on the design programme through design development as employer requirements are further clarified and confirmed. In addition to frustration and delays to the process this also results in wasted design effort.

On the other hand differences in experiences encountered by the different key participants of the D&B procurement appear to originate from the manner in which project risks have been 'pushed' down the supply chain. For instance D&B contractors bemoan the fact that all project delivery risks appear to be 'off loaded' by clients on to them which results in them passing them on to their supply chain including the designer consultant who is often sub-contracted by the D&B contractor to undertake design services. It would appear that this passing on of risks from the client to the contractor and from the contractor to the designer is the centre of most of the constraints that contractors and designers have faced when utilising D&B as a procurement method.

However on the basis of information obtained from the interviews undertaken it would appear that in the midst of such constraints key participants of the D&B procurement method have come up with good practices that have been developed to counter the negative effects of the constraints encountered. These themes have been captured in the model shown in Figure 5 below. Figure 5 below summarises the resultant node hierarchical structure of categories/themes/concepts that came out of the interviews undertaken with key participants.

Table 1: Summary details of the Interviewees interviewed

Management Level	Number interviewed	Number of years experience	Approximate value of D&B projects undertaken
Middle level	4	91	£750 million
Top level	5	116	£1.9 billion
Strategic level	6	174	£6.3 billion

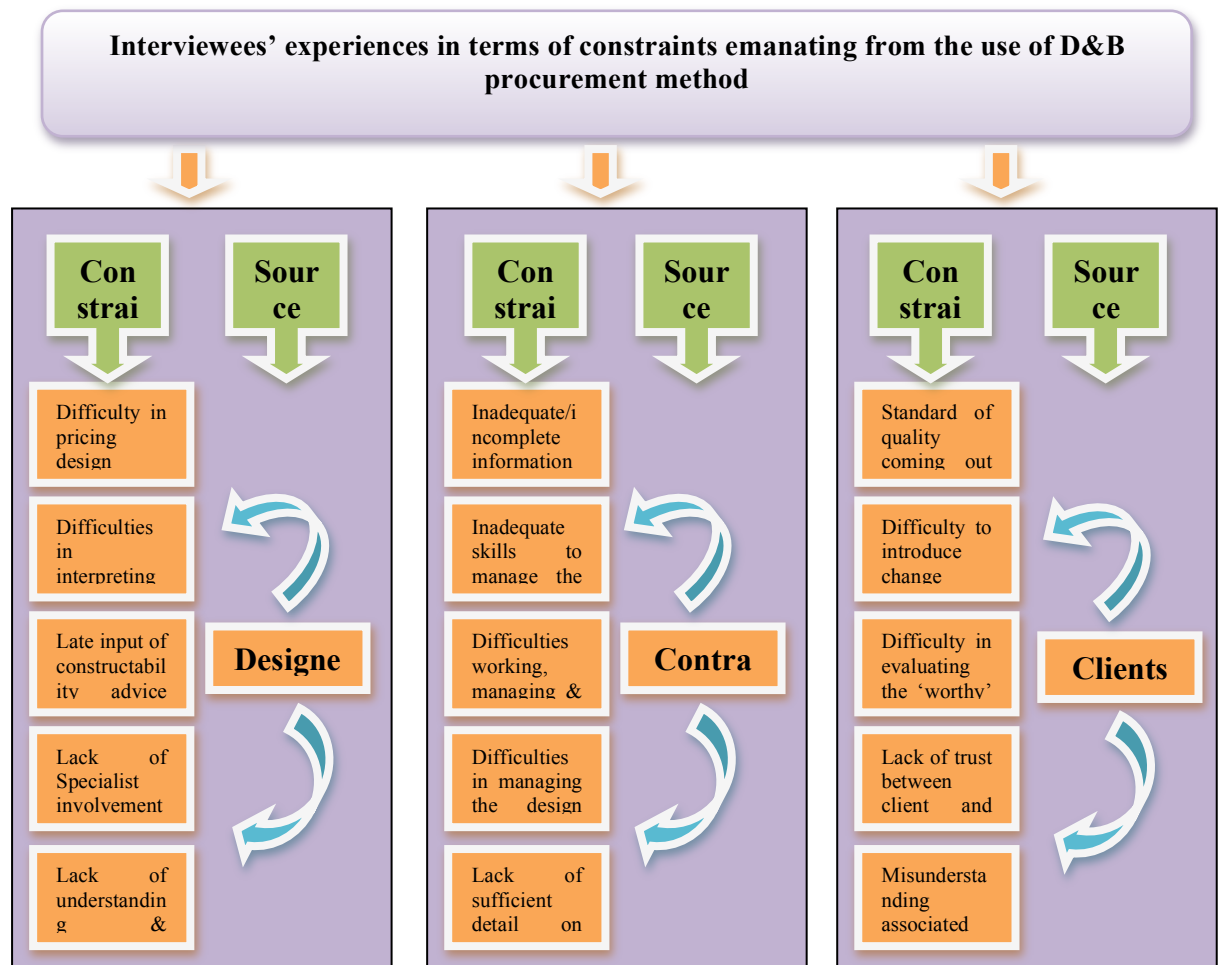


Fig. 4. Interviewees' experiences of constraints faced using the D&B procurement method

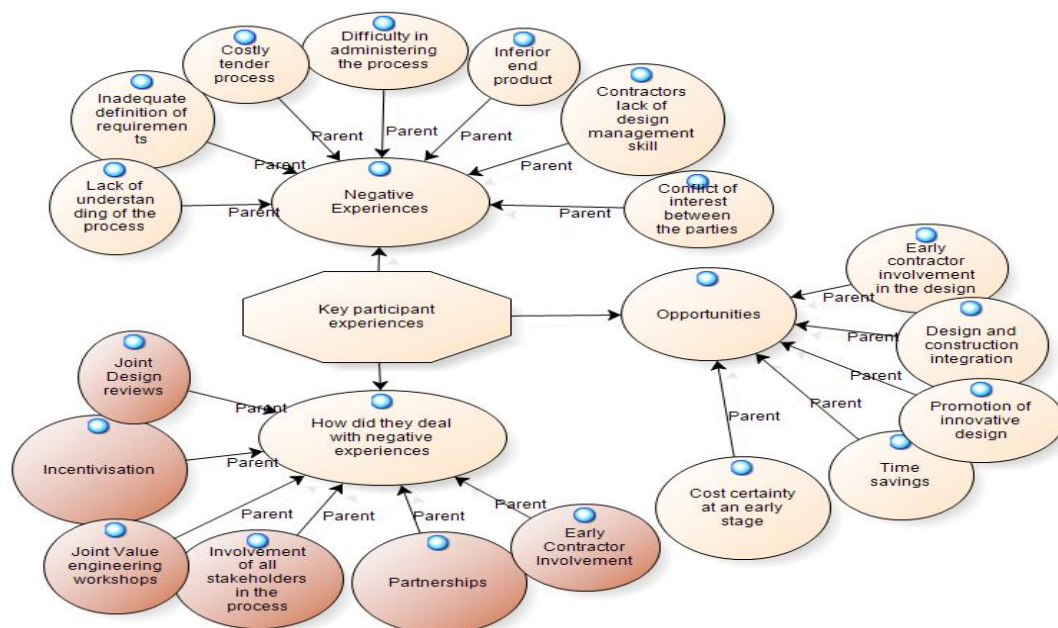


Fig. 5. D&B constraints and opportunities as experienced by key participants

The resultant model was developed through the use of Nvivo 10 data analysis tool and captured not only the constraints encountered but opportunities and some good practice that the interviewed key participants of the D&B procurement method have experienced over the years.

4.0 Conclusion

From the analysis of the results from the reviewed literature and the interviews undertaken with key participants of the D&B procurement method it would appear that, although integrating design and construction processes appear to be the way forward given the myriad of problems that the construction industry has had, there is a long way to go before the full benefits of integration can be realised.

The root cause of the constraints (which appear to be linked to D&B risk identification, analysis, allocation and management) associated with D&B procurement needs to be 'weeded' out and understood by both parties before adopting the current approach that appear to be 'pushing' design and construction risks down to the next party in the supply chain resulting in negative consequences being felt by the affected parties including clients. Of equal importance is to examine and exploit the benefits that would come out of the opportunities/strengths that have been highlighted by the key participants as depicted in the model in Figure 5 above. It is only by weakening the root causes of the constraints encountered by key participants as reported in this paper and at the same time promoting the opportunities/good practice that have been identified above that the industry can start to reap the potential rewards that D&B procurement can bring to the construction industry.

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The Implementation of UK Procurement Policy in University Refurbishment Projects

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Abstract

The Higher Education (HE) sector's deliverable has social, economic and environmental implications. The construction industry has a positive role to play, in assisting the sector to achieve desired outcomes, in relation to these implications. Since the formation of Her Majesty's (HM) coalition government in the UK in 2010, there have been a number of reports and strategies published, concerning efficiency and procurement in the construction industry. Such reports include HM Treasury's 2011 Construction Strategy, which sets out a model for construction procurement in the public sector. It is important to both the University Institutions, as well as HM's UK Government that the recommendations are implemented. The Government has a significant role, through the 'Higher Education Funding Council for England', to ensure it receives perceived value, when providing funding. This paper explores the 2011 construction strategy, and its associated documents. The reports are then related to a case study, which is an organisation providing teaching, research and other services within the North West of England. Data is collected with a pragmatic philosophical viewpoint from qualitative data, in the form of interviews, document analysis and participant observation. The findings of the research, form part of an on-going research project into collaboration. The research's value is in relating the government's agenda for improvement, to a sector, that due to recent reform has become more aligned with the private sector. The findings identify, that the case study is already moving towards the methods of best practice, identified in the strategy and associated documents. However, further support will be required from the Cabinet Office, to achieve full compliance, including integrated procurement, in smaller university organisations.

Keywords

Retrofit, Carbon Reduction, Procurement, University Institutions

Introduction

The UK Government's commitment to carbon reduction is seen in the Climate Change Act 2008. In Section 1(1), found in Part 1 of the Act, the secretary of state is put under a duty to reduce the UK carbon account by 80%, from 1990 levels by the year 2050. For the year of 2020, a reduction of 34% is required. There is an agenda to reduce carbon transfers to Universities, through funding requirements, set by central government (Universities UK; GuildHE; HEFCE, 2010, p. 7). As such, universities require their supply chains to collaborate, in order to implement carbon savings in a time of austerity. This collaboration with the supply chain is undertaken at project, and organisational level. In addition, Universities collaborate amongst

each other, at inter-organisational level. An advanced form of collaboration is where business activities are amalgamated between organisations, to reduce repetition and receive economies of scale. Amalgamated services may be facilitated through third party organisations, such as the Cabinet Office. This paper empirically relates the UK Government's contemporary agenda for collaboration, to a case study in the higher education sector. The psychological reasons 'why' practitioners collaborate is not explored.

Contextual Information

Project Collaboration

The implementation of collaboration at project level is explored in detail by Crowe and Fortune (2012). The paper is an inductive study into collaborative contractual behaviour, in the Higher Education Sector. The data is collected from interviews, obtained from three directors of supplier organisations, providing services to the higher education sector. During the interviews, the participants explored their understanding of collaboration, while reflecting on practice. Project level collaborative features emerging from the work, include: integration of supply chain knowledge into design; integration of other stakeholders; lessons learned meetings; procurement route; contractor selection; and incentivisation. Procurement included pre-construction involvement of contracting organisations. In addition, the pre and post contract integration of the contractor's knowledge in design is considered. There are similarities in the data with the Cabinet Office's 2011 Construction Strategy, which are not explored in the work.

The integration of supply chain and stakeholders knowledge, into design is a requirement set out in the construction standards, which are expected to be adopted by all government funded clients (Cabinet Office, 2011, p. 8). In the construction standards (Cabinet Office, 2012a), it is stated that procurement routes should be limited to those that support integrated team working. Types of procurement listed, include that associated to the Private Finance Initiative; Design and Build; and Prime Contracting. Further clarity in relation to procurement routes is provided in Cabinet Office's Construction Trial Project report (Cabinet Office, 2012b). The methods identified by the report include Cost Led Procurement, Integrated Project Insurance, Two Stage Open Book and centralised procurement.

In Crowe and Fortune (2012) one inhibitor to collaboration, is identified as competitive tendering. The procurement model of integrated project insurance, relates to where a client invites suppliers to compete, for the delivery of a project. In the model there is a step away from competitive tendering, towards a two stage approach. The team works up the scheme in line with a budget, which is checked against benchmarks. Cost overruns are financed through Integrated project Insurance. During a presentation at the CUBE in Manchester in March 2012, the Construction Category Head of the Cabinet Office's Efficiency & Reform Group related this form of procurement to the PPC 2000 (ACA, 2008) form of contract. PPC stands for Project Partnering Contract. The multi-party contract is entered into by both constructors and consultants, and represents a paradigm shift in contractual relationships.

There are mechanisms within construction contracts that are associated to collaboration. One identified in the Strategy (2011, p. 13), as required in construction

contracts is fair payment. Support for the ethos of fair payment also emerges from the 2009 Construction Act. Although they are not identified as mandatory, the strategy makes reference to project bank accounts. In relation to health and safety, a mechanism is set out in Section 3.5 (Cabinet Office, 2012a, p. 10) of the standards. This section specifies that clauses are to be included in contracts, providing that regular visitors to site should demonstrate their health and safety competence through such a scheme as CSCS. In addition, the standards state that contractors undertaking construction should be registered with a site management and/or good neighbour scheme, such as the Considerate Constructors Scheme.

The construction standards also set out mechanisms associated to project management which include value management, value engineering and whole life cycle costing (Cabinet Office, 2012a, p. 6). Section 2.4 of the standards sets out that value management should be undertaken to consider economic, environmental and social costs. This is in line with recent Legislation for Contracting Authorities, namely the Public Services (Social Value) Act 2012. This act applies to all Universities that receive more than 50% of their funding from public sources, as provided in Section 3(1)(W) of the Public Contracts Regulations 2006. The 2012 Act sets out under Section 1(3), an authority must consider “how what is proposed to be procured might improve the economic, social and environmental well-being of the relevant area”. This act legislates against contractors being selected based on lowest price only.

Other Legislation that promotes collaboration is the Health and Safety at Work Act 1974. The CDM regulations are made under authority of this act. Section 5 and 6 of the regulations specifically require cooperation. The Approved Code of Practice (ACoP) supports the CDM regulations, and is referred to in the Standards (Cabinet Office, 2012a, p. 7). In the ACoP, (HSE, 2007, p. 16) it provides that “clients should seek to appoint those who can assist with design considerations at the earliest opportunity so that they can make a full contribution to risk reduction during planning stages”. This statement is made among others in relation to contractors. Therefore, it can be seen that collaborative behaviour is required in order to be compliant, with the ethos emerging from legislation. In the case of health and safety, there is a requirement for early contractor involvement in design.

Organisational Collaboration

Universities have an organisational viewpoint, which becomes evident when applying for funding from the Higher Education Funding Council for England (HEFCE). In the proposed submission form for HEFCE’s Investment Framework, there is a requirement for an organisational or institutional viewpoint. The strategic viewpoint includes for the condition of the estate; space efficiency; carbon reduction; environmental performance; affordability; and institutional sustainability. To achieve the organisational viewpoint on these matters, there is a requirement to have an element of collaboration, between those that procure and construct building works. The organisational collaboration may be set out in a practice and procedures manual, to be implemented on a project by project basis.

Standardised procedures can be implemented in the form of a framework. Crowe and Fortune (2012) identify that frameworks are used to facilitate inter-organisation communication between supply chain partners, which provide similar services, in relation to health, safety and cost. In addition, competition is identified as being an inhibitor to the transfer of cost knowledge. In the procurement models set out in the

strategy (Cabinet Office, 2011), there is a move away from traditional competition with the integrated project insurance and two stage open book models.

The two stage open book and cost led procurement models, presented in the strategy (Cabinet Office, 2011), involve the use of a framework. The cost led procurement approach, involves a client putting in place a team of an integrated supply chain, which includes constructors and consultants. This integrated approach is similar to that currently the case, with the Management Agent Contracts used on the Highways, and the NHS's Procure21+ model. Under the cost led procurement approach, contractors able to deliver the scheme within the cost ceiling are selected based on a score. The score is derived at by examining the tendering organisation and its staff, representing a deviation from traditional competitive tendering methods. The two stage open book approach selects contractors in a similar fashion to the cost led approach, with the formation of the contract sum using open book methods.

Standard procedures may set out how different systems inter-operate, to provide an overall deliverable. Inter-operation of systems, however, brings with it an element of risk (McAdam, 2010, p. 3). Where data is transferred between systems manually, it creates work for practitioners, and brings with it risks associated to human error. The logical way to overcome this risk is through the use of a single consolidated electronic system, to manage the required deliverable, for the purposes of funding, governance and management of the organisation. The consolidated system also needs to manage the procurement process including contract administration. A similar consolidated system to be used at project level is explored by Bew and Underwood (2009) and Bew and Richards (2008). The suggestion in this paper is to extend the idea, from use at project to organisational level.

Inter-organisation Collaboration

Public sector funding is provided to universities, through the Department for Business Innovation and Skills, which sets the grant that is awarded to The Higher Education Funding Council for England (HEFCE). HEFCE in turn provides capital expenditure to the institutions, through the Capital Investment Fund 2 (HEFCE, 2011). Capital funding is provided in relation to learning and teaching (£49million); and research (£549million). As part of the funding requirements, inter-organisational data is provided from Universities to HEFCE. The Strategy (Cabinet Office, 2011) sets out that government's agenda for inter-organisational sharing of data, for example that in relation to 'Benchmarking' and the 'Construction Pipeline'. The sharing of data allows inter-department approach by central government, when managing supplier relationships.

The Strategy (Cabinet Office, 2011, p. 8) provides that supply chains will be developed through the use of forward programmes. The Cabinet Office provides data in the Construction Pipeline for larger projects, a small number of which relate to University buildings, in comparison to their overall population. A more accurate assessment could be made through the data provided from HEFCE. In addition, the new models for construction procurement require the inter-organisational sharing of benchmarking data. The Cabinet Office has started to collect this data from governmental departments (Cabinet Office, 2012c). If universities are to use the new models of procurement, they will also need to share data on an inter-organisational basis. For example a University may only construct one student accommodation

building every 10 years, as such would not have the internal benchmark data, within their organisation.

In addition to data, practice is shared on an inter-organisation basis. In relation to Universities shared practice is evident in work undertaken by Association of University Directors of Estates (AUDE) and the Cabinet Office. AUDE is a professional network. Shared practice is also identified in the Strategy (Cabinet Office, 2011, pp. 13-15), in relation to the standardisation of contracts and frameworks. In relation to frameworks, where bespoke forms of qualification are used, it is identified in the Standards that the supply chain can incur nugatory costs. To overcome this issue a standard form of pre-qualification is produced by BSi, namely PAS 91:2010. The standard form of questionnaire included within the document, provides clients with the health and safety performance information, as required by the Standards (Cabinet Office, 2012a, p. 8).

Integrated Procurement

Bakker, Walker, Schotanus, & Harland (2008) relate collaborative procurement to different organisational forms. The data for the study is collected from 33 explorative interviews, and government agency reports published in the UK. The reports include that by the 'Office of the Deputy Prime Minister', 'Beecham', the 'Audit Commission', and the 'NHS Purchasing and Supply Agency'. The research identifies professional networks, which can be related to inter-organisational collaboration. In addition, third party advisory, third party purchasing and shared services are identified, which represent full procurement integration.

The review of frameworks to reduce duplication is identified in the Strategy (Cabinet Office, 2011, p. 15). Fully integrated procurement is where organisations share services, in order to reduce duplication and enjoy economies in scale. Centralised procurement is seen as a model in the Construction Trail Projects report (Cabinet Office, 2012b). Central frameworks identified in the report include that for Modular Buildings; Building Materials; Project Management and Full Design Team Services; Estates Professional Services; and Environmental Sustainability. A local Authority example is the Greater Manchester Combined Authority.

A truly integrated system would be similar in nature to that described by Bew and Underwood (2009) and Bew and Richards (2008) in the form of iBIM; with all data stored remotely. Under a fully integrated system different institutions would have full and open access to each other's data from a shared server, for the purposes of procurement, design and estates management. Professionals working for different Universities would be able to access designs for similar buildings, and supply chains through a shared system.

Research Methods

Literature is used to develop a Taxonomy for Collaboration. The Taxonomy is then related to a single University organisation, herein referred to as 'the case study'. Data is collected during a period where the researcher worked within the case study, and as such the research involves participant observation. Data is collected from field notes and interviews undertaken in 2011/12. There is a focus on an Interview of the Assistant Director of Estates (ADE). Thematic analysis is employed to interpret the data. The study provides an empirical representation and as such a reflexivity journal

was not employed. There is no attempt to understand the meanings behind the interview data. In the context of this research, to understand ‘why’ people collaborate.

To ensure the validity of the data, a strategy provided by Robson (2002, p. 174) has been employed, which includes: prolonged involvement of the participant observer; triangulation of the data; peer debriefing through publication; checking of transcripts by interviewees; and audit trail during data collection. Other data includes that provided in the form of standard documents published by the organisation including policy documents. It also includes the data explored during the contextual section of this paper. The data is provided in such a way to protect confidentiality.

The case study is partially selected on a pragmatic basis, in that the researcher was working within the organisation. The case study was also selected based on its broad contribution to teaching and research. A 2010/11 review published by the case study identifies that 25% percent of its income originates from funding council grants; 31% tuition fees and educational contracts; 24% research grants and contracts; 18% operating income; and 2% from endowment and investments. It can be seen that the organization is funded in such a way that it could not be described as strictly public or private sector. The organisation undertakes a broad spectrum of projects. A project, herein referred to as ‘the project’, is selected from within the organisation as a further focus within the case study. The selection was made on the basis that it fits a profile of a retrofit project, associated to the carbon reduction agenda. The projects final account sum fell between £800thousand and £1million.

Data

Project Collaboration

ADE identified that “the way that this organisation approaches the formal contract situation is we would much rather work in a partnering type environment and leave the contract behind”. The project was let using the Joint Contracts Tribunal’s (JCT’s) Standard Building Contract without Quantities 2005 revision 2. This suite of contracts does not include the collaborative features, included its 2011 suite of contracts. There are minimal amendments to the contract, in accordance with the case studies procedures manual, discussed later in the paper. In contrast, when discussing the overall institution, ADE indicated that “in the last couple of years” there had been a “move to D&B” by the organisation; and on a recent couple of “projects we’ve novated the architect and novated the M&E”.

The project was procured in four phases. The design included in the tender was phase one works, which on completion represented 15% of the final account sum. The two other phases were included in the contract as provisional sums, in which the main contractor priced for overheads, profit and preliminaries; these phases were tendered to sub-contractors after start on site. The main contract had been let between the parties prior to start on site. Three of the phases were in the contract prior to construction; and an additional fourth phase was added during construction.

The work was undertaken in a live environment within a listed building. Parts of the design could not be undertaken, until elements of the building fabric were opened up. The use of a two stage tendering approach allowed for design integration, even though a design and build approach was not undertaken. To integrate operation into the design and construction of the project, a representative of the building operators

attended regular project team meetings. ADE supported this stance, by recognising the importance of a building operator's involvement. The building operator was a different department than that of estates within the case study. Methods to promote operational integration not considered for the purposes of the project included the use of 'design, build and operate' and 'private finance initiative' forms of contract.

There was no formal process of risk management at project level. Instead risk was managed at an informal level. ADE identified that risk management is "about good judgement rather than the hard output of a risk register". In addition there was no formal life cycle costing undertaken by the design team. Perhaps this was due, as identified by ADE, to lifecycle costing being "not something that's been effective in the whole business case of having a project approved". The project was however undertaken to offer energy savings over the life cycle of the estate. In addition, there was no formal change management process used on the project. ADE indicated that formal change management is not used for projects with a value of less than £1million.

Organisational Collaboration

The organisation undertakes an estate wide viewpoint which can be seen in its estates strategy. In the strategy there is a commitment to health and safety; space efficiency; functional suitability; carbon reduction; and institutional sustainability. The commitment is confirmed by the organisation, meeting the requirements of Capital Investment Fund 2, as indicated by HEFCE. ADE also indicated that he had been "tasked with looking into understanding what the carbon impact is both from an embedded carbon and operational perspective".

The case study's estates department operates procedures manual for use within its sub-department, which undertakes construction professional services for projects up to the value of £2.5million. The sub-department is herein referred to as PSU. There is a separate part of the organisation that deals with major projects. The procedures manual sets out a process where contractors are selected from a framework to tender. The project case study was procured using a framework by PSU. Contractors are then selected, on the return of a compliant tender, typically based on cost. ADE indicates "it's not something we would then start a Dutch auction about". The procedures manual does cover for the eventuality of where contractors are selected, on a basis other than cost.

The institution provides consultants with access to an electronic system where members of the design team can find guidance. The online system also provides access to standard documents including preliminaries and contract conditions. The contract conditions provided are the minor works, intermediate and standard (without quantities) forms of contract, of JCT's 2011 suite. Within the minor works and intermediate forms there is the option for design portions. The 2011 suite is a later edition than that used in the project, due to timescales in procurement. Minimal amendments are made to the standard forms of contract. The use of standard contracts with minimal amendments for construction works, is an inter-organisational approach to working, using a third party, namely the JCT. In contrast the form of consultants' appointment is indicated by the case study's Contracts Governance Policy, as being bespoke.

The project's contract is traditional and lump sum; there is no inclusion for financial incentivisation, in respect of shared savings. ADE identified that at project level "we would not be offering financial incentives" with it being "more about repeat work". The contract includes a mechanism to withhold retention, but not for the provision of a bond. It is left open to be decided, on a project to project basis, by the manual if the items included in the eighth recital of the 2011 suite apply. These items associated collaboration include: collaborative working; health and safety; cost savings and value improvements; sustainable development and environmental considerations; performance indicators and monitoring; and notification of disputes.

On the project, the mechanical and electrical sub-contractors were selected to tender, from a tender list, owned and managed by the University. In the case of where a trade was not on a tender list, a list was created and agreed between the contractor and the consultants. ADE indicated that in the past, sub-contractor selection was made from a university managed sub-contractor framework, however, decided that now "it's more advantages to have contractors use their own supply chain arrangements". ADE further indicated that now "the University does not manage relationships with suppliers, local or otherwise".

When discussing collaboration ADE identified that "the softer side is more about generating those relationships at a senior level away from the site team, away from the consulting team". The University uses frameworks to develop relationships. ADE confirmed this when indicating that "there's a high level framework meeting where all the directors and contractors are invited to on a quarterly basis". A similar scenario was also presented for consultants. The market nature of the UK Economy, however, means suppliers that work for the University also work for other Universities; creating an informal pathway for the inter-organisational sharing of knowledge.

The information was prepared for the project to either level 0 or early level 1, of Bew and Richards 2008 BIM Evolutionary model. All drawings were presented in 2D. ADE indicated that the University did not have an implementation plan for BIM. There was not a formal process to share information between the project and other similar projects within the organisation, for example, for the purposes of costing. However, consultants and employees on the project were also involved with other projects within the University allowing data to be shared informally.

On the project there was no attempt to review performance in relation to a project review meeting or key performance indicators (KPIs). It is however noted, that a performance review meeting has been attended by the researcher, on a different project for the organisation. The review was undertaken in a qualitative, interpretive fashion using reflective practice to form lessons learned. In respect of harder data ADE indicated that "we don't have key outputs in terms of KPIs hard data metrics".

Inter-Organisational Collaboration

An inter-organisational approach is where two or more Universities come together for the purposes of developing their supply chain. The institution undertakes an inter-organisational view point. ADE indicated on one occasion that he had offered to help a smaller university, which had not taken up the offer. The case study is a member of AUDE, which is an organisation set up to assist inter-organisational collaboration, during the strategic planning, management, operation and development of HE estates and facilities; doing this through provision of management tools, conferences,

discussion forums and training events for members. AUDE provides the forum for informal relationships to be formed. ADE indicated that such informal relationships are particularly useful with other professionals undertaking the same role within other universities.

Integrated Procurement

Integrated procurement is where two or more organisations come together to procure the services of a supply chain. AUDE identifies the North Western Universities Consortium, which operates in the same location as the case study. The web site of the consortium indicates that the case study is not a member. ADE did indicate however that “We’re just tendering our waste contract as a shared service”. In addition to undertake procurement through a third party organisation it may also be undertaken through shared staff. ADE indicated that the case study undertook limited sharing of staff.

ADE identified that the University has in relation to consultants “moved away from an internal framework arrangement to using OGC, which is a framework arrangement”. The OGC is an abbreviation for Office of Government Commerce. The OGC’s buying solutions is at the time of publishing this paper named the ‘Government Procurement Office’, which is an executive agency of the Cabinet Office. In contrast to this integrated method of working, ADE indicated the organisation had recently started their “own contractor framework for projects up to the OJEU threshold”.

Data Reconciliation with Literature

Data Reconciliation Documents that outline the UK Government strategy to procurement of construction services are explored and related to literature in the contextual information section. The discussion is then used to develop a taxonomy for collaboration in Table 1. There are four progressive levels identified in the table. The items are then ticked or crossed depending on whether that form of collaboration operated within the case study.

Conclusion

The current coalition government in the UK, is attempting to implement a rigid approach, to procurement in relation to construction projects, undertaken using the public purse. Universities are funded in a fragmented way that includes both public and private sector finance. The balance of funding has been shifted away from the public sector towards the private sector. This makes it less clear cut than other bodies, which receive a much larger proportion of their funding from governmental departments. The current mechanism for government to promote compliance with its objectives is through gateways to funding. These gateways are available to be developed further if the current procurement strategy is to be implemented within the organisations. Alternatively the new routes to procurement may be promoted thorough the demonstration and promotion of best practice, and what this can offer to organisations

The significant contribution to capital expenditure, from the public purse creates a requirement for central government to adopt an approach to procurement, within University organisations. The governmental approach is implemented through the

Cabinet Office, which has published a series of strategies and reports; a significant report being the 2011 Construction Strategy. The strategy outlines in its executive summary that it intends to replace adversarial with collaborative ways of working, through the use of model for procurement. Collaborative features considered in the strategy include those at project, organisational level, which includes a radical rethink on the contractual relationship between public sector clients and the supply chain. More time and further research is required to understand the full implication of collaborative practice, in respect of project and organisational level risks.

The biggest step however is the implementation of collaborative features at inter-organisational and integrated levels. There is interest in inter-organisational cooperation as can be seen in the case study. There is also interest in collaboration at an integrated level, which is also seen in the case study. To fully achieve integrated collaboration further research work is required in relation to both the communication software and infrastructure. Further research is also required into the motivation to implement such a system.

Table 1: Taxonomy for Collaboration

Level	Collaboration	Characteristics	
1	Project	a. Legislation compliance ✓ b. Considerate contractors ✓ c. CSCS ✓ d. Value Engineering/ Management ✓ e. Open book tendering ✓ f. Dispute ladders ✓	g. Change management ✓ h. Design Integration ✓ i. BIM Level 1 ✗ j. Incentivisation ✓ k. Target cost ✓ l. Integrated Project insurance ✗ m. Life cycle costing ✗
2	Organisational	a. Practice and Procedures Manual ✓ b. BIM Level 2 ✗ c. Performance Review ✗ d. Estate Strategy ✓ e. Fair payment strategies ✓	f. Project Bank Accounts ✗ g. Frameworks ✓ h. Consolidated software ✗ i. HEFCE CIF Compliant Estate strategy ✓
3	Inter-organisational	a. Benchmarking ✗ b. Standardised contracts not amended ✓	c. Standard frameworks ✓ d. Professional Networks ✓
4	Integrated	a. Shared data storage with open access for all institutions ✗	b. Shared services ✓

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Cultural Considerations Relating to the Commercial Aspects of International Construction Projects: A Case Study Approach

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Abstract

Considerable resources are expended in the preparation of time and money claims on international construction projects. Experts in delay analysis and quantum are often instructed to assist in the process of assessing the effects of change and unforeseen events. A distinguishing factor of international construction projects is the challenging environment in which such projects are sometimes constructed whilst also involving stakeholders from several different countries. These challenges can be economic, physical and / or political. Cultural issues and cultural differences are a fundamental part of the challenge that international construction projects present. Whilst there are discrete bodies of research relating separately to claims and culture in relation to international construction projects the impact of cultural issues on the outcome of the claims referred to above are often overlooked. This paper explores how a case study approach can inform research in this area.

Keywords

Case Study, Construction, Culture, International.

Introduction and Background

In an increasingly global construction market (Global Construction Perspectives and Oxford Economics 2009, p.2) the need for cultural intelligence and an awareness of the important role culture plays in international construction is more important than ever before (Cartlidge 2006, p.237).

The subject area for this paper emerged from a doctoral research study titled “Cultural Considerations In the Preparation, Evaluation And Negotiation Of Time And Money Claims On Large International Construction Projects”

The core of the study’s rationale is that appropriate consideration is rightly given to a number of key aspects which influence the outcome of time and money claims however, cultural issues are often overlooked.

International construction projects are projects in which the employer / owner, contractor / subcontractor, contract administrators, project managers and designers are not of the same nationality and at least one of the stakeholders is working outside its country of origin (Chan & Suen 2005, p.292).

“Time” and “Money” based claims relate to the requests and substantiation that a contractor / subcontractor may typically submit to an employer / owner during the course of a project in relation, for example, to an extension of time to the completion date for a construction project and / or for the payment of additional monies in respect of the occurrence of certain employer / owner responsible eventualities.

Perhaps the most challenging term to define in the chosen area of research is “culture” and importantly its meaning in the context of the chosen area of research.

Hofstede (1984, p.21) developed a widely accepted definition of culture in business describing it as:

“...the collective programming of the mind that distinguishes the members of one human group from another...Culture, in this sense, includes systems of values; and values are among the building blocks of culture”

Cartlidge (2006) usefully relates Hofstede’s work to the international construction sector and points out that cultural differences within the property / construction sectors can be seen to operate on a number of levels which Cartlidge (2006, p.265) summarises as:

“...Business / economic factors – e.g. differences in the economic and legal systems, labour markets, and professional institutions etc of different countries...”

and

“...Anthropological factors, such as those explored by Hofstede (1984)...”

Cartlidge (2006, p.236) drew on this seminal work by Hofstede (1984) and observed, specifically in relation to construction companies operating in the international construction sector, a growing realisation of the importance of cultural intelligence and its impact on the profitability of such companies.

The researcher’s interest in this subject had its foundations in participant observation and critical reflection in industry.

The findings of an applied literature review corroborated the observations from the critical reflection and confirmed the existence of an obstacle to construction companies in the international sector in relation to the relatively low level of cultural intelligence (Cartlidge 2006, p.236).

Knutson (2005, p. xi) had also observed a similar problem when negotiating the terms of international construction contracts and Knutson concluded the problem was created by a lack of understanding of the cultural background of an opposing party to negotiations. Importantly, Knutson (2005, p. xi) identified the commercial advantages that a basic understanding of one’s opponent’s cultural standpoint might provide.

The extent of the problem relating to the cultural influences on the preparation, evaluation and negotiation of time and money claims on large international construction projects can be gauged by considering the size of the international construction market.

Estimates of the size of the international construction sector vary from between USD 2.27 trillion and USD 7.5 trillion (Global Construction Perspectives and Oxford Economics 2009, p.2). It has also been suggested that global construction currently accounts for 13.4% of the World’s output and this figure is estimated to increase to 14.6% by 2020 (Global Construction Perspectives and Oxford Economics 2009, p.2).

According to a recent survey considering the causes of time and money claims in the international construction sector by EC Harris (2012, p.3) the global average size of a construction dispute is USD \$ 32.2 million with an average dispute duration of 10.6 months.

From an analysis of the above it is firstly apparent that a problem exists in terms of time and money claims in the international construction sector and secondly, the sector is an enormous market and one which is set to continue to grow. It is also apparent that cultural intelligence is a contributory factor in determining the profitability of international construction projects.

Having clearly established that a problem exists, it is necessary to consider the design of a research project to investigate this problem further.

Identifying An Appropriate Research Method To Investigate The Problem:

Fundamental to the research subject matter is an in depth understanding of the human aspects of the research question. The key themes within the subject area of the research are: culture in construction and the impacts of culture on the preparation / evaluation / negotiation of time and money claims.

Schein (1992, p.12) refers to culture as being a pattern of shared basic assumptions. In her work understanding organisations and Miller (2012) expanded upon the cultural metaphor in relation to organisations as cultures. As Miller points out (Miller 2012, p. 82) the cultural metaphor derives from the field of anthropology where scholars study the cultures of nations, tribes and ethnic groups.

Miller (2012, p.94) argues that many researchers believe that qualitative methods are the most appropriate for gaining an understanding of the complicated, fragmented and changing nature of cultural groups and uses the example of the work of Strauss & Corbin (1990) in relation to qualitative research techniques.

If one considers that the “culture” metaphor emerged from anthropology it is not surprising therefore that a qualitative approach, which focuses on subjective data and in particular people’s perceptions, is widely promoted in the study of culture.

As Dainty (2008, p.1) observed the positivist paradigm, with a strong reliance on a quantitative approach, has been the more dominant approach to research in construction management. However, as Bryman and Bell (2003, p.15) noted there is an increasing awareness of the importance of understanding human behaviour in research in the built environment.

As previously stated the subject area of this research emerged from practitioner engagement on a number of international construction projects with construction professionals from an eclectic range of cultural backgrounds and from observing the behaviour of construction professionals with differing approaches which appeared to be influenced by their cultural standpoint.

Chan & Tse (2003) noted similar observations and argued that careful account must be taken of the cultural influences on the management of international construction projects.

There has also been a substantial body of research that has addressed the cultural aspects of international construction projects. For example, Hall & Jaggard (1998) focused in on a particular aspect of culture in industry, namely construction management and the behaviour of expatriate UK construction professionals working overseas.

In attempting to identify an appropriate research strategy for the study of culture within the international construction sector it is necessary, as Hall & Jaggard (1998)

did, to explore both the quantitative and qualitative paradigms for an appropriate methodology.

The research methodology adopted by Hall & Jaggar (1998) in the above study was fundamentally positivist with extensive use of quantitative data obtained from completed questionnaires.

Hall & Jaggar (1998, p.62) justified their chosen research methodology as follows:

“...the complex nature of the topic meant that an ideal research instrument would be qualitative in nature. However resource limitations precluded many qualitative data gathering techniques which are characteristically time consuming and personal in nature...”

As noted previously, the interest in the chosen area of research for the doctoral study emerged from observations of unexpected behaviour on various international construction projects. It is the interpretation of the behaviour of individuals from different cultural backgrounds involved in the commercial aspects of international construction projects where the true focus of the research lies.

Any research approach in the chosen area of study must provide an in depth insight and immersion in the matters being studied and involve an interpretative inquiry and a critical analysis of industry practice. It was therefore necessary prior to deciding upon the chosen research methodology, which is outlined below, to ensure that the methodology fully reflected these priorities.

Case Study: A Proposed Research Methodology:

The importance of the human behaviour element to the subject area of the research has been outlined previously. It has also been established that many researchers consider that qualitative methods are more appropriate in gaining an understanding of the complicated, fragmented and changing nature of cultural groups (Stauss & Corbin 1990) and Hall & Jaggar (1997).

Costley, Elliott & Gibbs (2010, p.89) argued that a case study approach would be particularly relevant to such research.

Simons (2009, p.21) defines a case study as:

“...an in depth exploration from multiple perspectives of the complexity and uniqueness of a particular project, policy ... in a ‘real life’ context ...”

The most commonly cited author in terms of case studies is Robert Yin. Yin (2009) defined a case study as:

“...a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within a real life context using multiple sources of evidence...”

Yin’s (2009) definition identifies a number of key elements to a case study. In terms of the chosen subject area the contemporary phenomenon to which Yin (2009) refers would be the influence that culture has on international construction projects. Another key aspect of the doctoral research is how those cultural influences impact in a real life context. The empirical nature of a case study that Yin (2009) describes is also extremely relevant to the sources of the original interest in the research topic.

A certain type of case study aligns well with an interpretative approach necessary in a study of this kind that espouses the importance of understanding human behaviour that the research project seeks to investigate. As Thomas (2011, p.124) explains:

“...Often, when a case study is written about in academic literature, what is being discussed is an interpretative case study...the aims of a case study and the style of interpretative inquiry dovetail...”

Both an interpretative case study and interpretative inquiry call for what Thomas (2011, p.124) describes as “...rich, intensive understanding...”

Interpretative inquiry is often associated with an ethnographic study or ethnography (Thomas 2011, p.125) which literally means the “writing of culture” and it is clear that such an approach lends itself well to the doctoral research subject area.

The decision to choose to analyse a single case study or analyse multiple case studies is a point that Yin (2009) considers. Yin (2009) identifies the advantages that a single case study provides when the case study in question is unique or highly unusual.

In contrast Stake (1995) recognises the advantages that multiple case studies can present:

“...With multiple case studies, even those containing just two cases, the results will always be more compelling, assuming that they are in support of each other and therefore easier to defend...”

It would appear therefore that an extremely effective research tool for capturing and analysing the complex interaction of the intangibles associated with human behaviour, such as culture on international construction projects, is a case study.

Alternative approaches to the research design were considered including exclusively quantitative methodologies. However for the reasons considered previously it was essential that any proposed research methodology reflected the importance of understanding the human aspect of the research subject matter and in particular how cultural differences influenced commercial aspects of international construction projects. The use of a case study strategy does not entirely preclude the use of quantitative research tools; indeed the adoption of such quantitative tools can be extremely valuable in triangulating any findings from case studies.

The need to draw on multiple sources of evidence in an attempt to triangulate any findings from a case study approach provides scope therefore for engagement with both quantitative and qualitative approaches.

Proverbs and Gameson (2008, p.100) note the importance of triangulation in research involving case studies and describe a case study approach as a strategy comprising different combinations of data collection including interviews and documentary evidence. Proverbs and Gameson (2008, p.101) point out that all evidence will be of interest to the case study researcher and that typical evidence that should be collected includes: documents, archival records, interviews, detached or direct observation and participant observation.

Of particular relevance to subject area of the doctoral research, given that the subject emerged from engagement on a number of international construction projects with other construction professionals, is participant observation.

As Hall & Jaggard (1997, p.62) discovered qualitative approaches can be very time consuming particularly when they involve research subjects from different countries and this is particularly true of an ethnography. In the context of the doctoral research a meaningful ethnographic study is likely to be prohibitive in terms of resources and time. Rather than carry out a full ethnography alongside the case study, the research design will instead draw upon ethnographic techniques, such as participant observation, to inform the case study.

Set out below is a description of a proposed research method which outlines the essential aspects of the proposed design for the doctoral research.

Research Method: Multiple Case Studies

The chosen research methodology is be predominantly qualitative in its approach using selected multiple case studies from international construction projects. The advantages of a multiple case study approach are that they ameliorate the danger of analytical or theoretical generalisation that reliance upon a single case study can present and they provide a greater opportunity to consider different types of culture.

Yin (2009) suggests that undertaking multiple case studies is analogous to undertaking an experiment numerous times in order to provide a greater level of confidence in the outcomes.

In selecting appropriate multi cases studies and deciding upon an effective research strategy detailed planning is required.

Yin (2009) recommends developing an analytical strategy towards preparing and conducting case studies that is in place before information is collected. In order to provide a rigorous research framework consideration needs to be given to each of the following aspects associated with the multiple case studies: Research Design, Data Collection, Data Analysis, Interpretation and Reporting.

In terms of developing the case study strategy Yin (2009) advocates it is firstly necessary to identify potential case studies for the proposed research and to set out a plan of work and programme to complete for the research.

Type Of Case Study:

Yin (2009) explains a wide range of different types of case study that can be undertaken such as: Critical, Extreme Or Unique, Longitudinal, Representative and Revelatory. Thomas (2011, p.77) reformats Yin's categories into three main types of case study: Key Case, Outlier Case and Local Knowledge Case. According to Thomas (2011, p.86) a Local Knowledge Case is one which is founded in some special knowledge or an unusual observation that has resulted in curiosity in the subject area being created.

The subject area of the doctoral research emerged from observing unusual and often inexplicable behaviour at commercial meetings on international construction projects. In attempting to classify the type of case study proposed to be undertaken, it would be appropriate to refer to the proposed multiple case studies as being Local Knowledge Cases. The selected multiple case studies are exploratory in nature with the purpose of exploring the subject area and seeking a deeper understanding. Having determined the type of case study to be undertaken it is necessary to identify appropriate projects to form the subject matter of the multiple case studies.

Identification Of Multiple Case Studies:

The identified multiple case studies for the doctoral research together with relevant project particulars are set out below:

Case Study 1:

Power Plant Project In The Middle East With A Contract Sum Of \$120 Million.

- 150 Week Delay on 102 Week Original Programme.
- Complex Retrospective Delay Analysis.
- \$30 Million Prolongation & Disruption Claim.
- Sectional Completion Dates and Milestone Payments.
- Stakeholders from: Denmark, Egypt, Israel, Lebanon, Palestine, Sweden, United Kingdom and United States of America.

Case Study 2:

Power Plant Project In Western Europe With A Contract Sum Of €50 Million.

- 66 Week Delay On 90 Week Original Programme.
- Interpretation of the term “unavoidably incurred”.
- €10 Million Prolongation & Disruption Claim.
- Sectional Completion Dates and Milestone Payments.
- Stakeholders from: Germany, Italy, Netherlands and United Kingdom.

Case Study 3:

Water Treatment Project In Eastern Europe With A Contract Sum Of €28 Million.

- 100 Week Delay On 180 Week Original Programme.
- European Union Funded Infrastructure Project.
- €12 Million Prolongation & Disruption Claim.
- Sectional Completion Dates and Milestone Payments.
- Stakeholders from: Belgium, Germany, Romania, United Kingdom and United States of America.

Case Study 4:

Offshore Oil & Gas Project In Caspian Sea With A Contract Sum Of \$200 Million.

- 24 Week Delay On 156 Week Original Programme.
- Multinational Joint Venture Project.
- \$66 Million Prolongation & Disruption Claim.
- Sectional Completion Dates and Milestone Payments.
- Stakeholders from: Azerbaijan, Turkey and United Kingdom.

Case Study 5:

Shipyard Construction Project In South East Asia With A Contract Sum Of \$22 Million.

- 100 Week Delay On 104 Week Original Programme.
- Significant Language Difficulties.
- \$14 Million Prolongation & Disruption Claim.
- Sectional Completion Dates and Milestone Payments.
- Stakeholders from: Denmark, South Korea, Malaysia, Singapore, United Kingdom and United States of America.

The rationale for deciding to focus on these chosen case studies was based on a number of factors. All of the above case studies were projects which the researcher was actively involved in as a Chartered Quantity Surveyor / Commercial Manager in industry and it was as a consequence of the knowledge and observations derived from these, and other projects, that the interest in the area of research in question emerged.

The aim of the doctoral research is to obtain a more complete picture of the issues surrounding the influences that cultural issues can have on the commercial issues on international construction projects. As Thomas (2011) observes it is for these very reasons that a case study approach is considered to be an extremely effective research method.

The above case studies were selected because, as Thomas (2011) describes, they are “local knowledge cases” in that they are an example of something that lies within the researcher’s own personal experience involving issues which lie at the core of the research.

Five case studies have therefore been chosen to form part of the study in order to ensure that the study is as broadly representative as possible in terms of; cultures, industry sectors and different countries.

The researcher hopes that the multiple case study approach will allow a “...rich, intensive understanding...” (Thomas, 2011 p.124) to be gained in relation to the importance of cultural factors on the commercial aspects of international construction projects that will enable new knowledge to be created in this field.

An important overriding factor in respect of the identified multiple case studies is the involvement of the researcher in the case studies themselves. This, in itself, presents some potential pitfalls relating to the impartiality of the researcher and the pre-conceptions that the researcher might already possess. Yin (2011, p.42) refers to “insider research” and the issue of the personal relationship that a researcher might have with participants in a study and emphasises the importance, particularly where there is likely to be an element of participant observation, of reflexivity.

Reflexivity has been described by Gill & Johnson (2010 p. 242) as the monitoring by a researcher of the researcher’s impact upon the study under investigation. This is particularly relevant to the chosen research method where the researcher is adopting a form of “insider research” in the identified multiple case studies.

The challenges of insider research and an awareness of reflexivity are important considerations that must be monitored throughout the research project. These are issues which can be usefully addressed in the single pilot case study the researcher proposes to undertake in advance of the other case studies in order to ensure appropriate processes are implemented in the doctoral research as a whole.

Conclusions

The introduction to this paper highlighted the increasing importance of cultural intelligence and the important role culture plays in the commercial aspects of international construction projects.

From both critical reflection on practice and engagement with relevant literature an hypothesis emerged that whilst appropriate consideration is rightly given to a number

of key aspects which influence the outcome of time and money claims on international construction projects, cultural issues are often overlooked.

The main doctoral research seeks to investigate whether cultural influences impact upon certain aspects of time and money claims on international construction projects. Given the enormous value of the international construction sector and the increasing importance of cultural awareness it is evident that a study in this area is both worthwhile and timely.

This paper concludes that when one is investigating human behaviour and at the same time seeking to obtain a "...rich, intensive understanding..." of an industry relevant problem Thomas (2011, p.124) a multiple case study approach can be both an effective and robust research method.

The proposed research methodology outlined in this paper aimed at addressing the above research question will rest in the qualitative paradigm, adopting an interpretative stance and will primarily rely upon the use of five multiple case studies which will be informed and triangulated by various sources of evidence that together will constitute an empirical investigation within an industry setting. It is proposed to initially undertake a single pilot case be undertaken ahead of the other four cases studies in order to verify the robustness of the proposed research methodology and method and identify any improvements to the proposed research design. The outcome of the wider doctoral research is intended to be the development of a framework addressing the impact of cultural influences in relation to aspects of time and money claims on international construction projects based upon the findings of the case studies described in this paper.

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Design and Urban Development

A review of construction SMEs' safety performance; where are we and why?

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Abstract

Statistics show that the construction industry was responsible for 49 out of 171 UK industry fatalities in 2001/ 2012. SMEs reported 70% of these 49 fatalities. One tool used by large construction firms to manage health and safety is performance measurement. Often SMEs do not have such systems in place. The research question sought to identify factors that impede good safety performance in SMEs and items of good practice in large companies which can be applied to SMEs. Long qualitative interviews were conducted with ten industrial practitioners and two academics. Content analysis shows the performance of large construction firms may be considered excellent; some argue that perhaps there is not much more that can be done to secure further improvements. However, SMEs' safety performance is perceived to be of great concern. The study identified pressures of finance and unnecessary competition as reasons why accidents are prevalent amongst SMEs.

Keywords

construction, health and safety, performance measurement, SMEs

Introduction

Health and safety statistics published recently in the UK show that there are more deaths in construction than in any other industry; with global figures showing that the industry contributes about one in six industrial fatalities per year (Vasconcelos *et al*, 2011). The International Labour Organisation (ILO, 2011) asserts that health and safety performance in construction causes a fatality every ten minutes. Evaluation of fatalities in UK construction reveals that 82% of all reported health and safety injuries occur within Small and Medium Enterprises (SMEs) and, in some cases, these figures rise to 90% of fatal accidents at work (Philips, 2011). The high fatality rate in construction and the scale of SME involvement in unsafe acts are frustrating. Garengo *et al* (2005) argue that it is extremely difficult for SMEs to attain high safety performance standards because of the very nature and conduct of their business, which, for obvious reasons, sometimes does not encourage upholding safety best practice and good safety performance measurement compared to larger companies. Indeed, most small business owners do not use safety performance measurement at all, because they see it as an unnecessary bureaucratic burden on their business (McKinney, 2002).

The Organisation for Economic Cooperation and Development (OECD, 2010) claims that incidents leading to fatalities are high in construction because SMEs constitute over 90% of the total workforce, and that this category of business is most unlikely to support dedicated health and safety performance measurement, regardless of good intentions to protect the people and processes at work. SMEs' safety performance is usually hampered by a host of factors, but more significant is the fact that most SMEs are bedevilled by potential organisational conflict between the pressures of generating income and protecting staff from occupational hazards (Deighan, 2009). Moreover, SMEs frequently trade on a reputation for reliability, quality and competitive costs. Such goals, although not exclusive, may be at variance with good safety performance (Youngblut, 2006). Apart from the nature of business and cost factors, many small firms often appear to be unaware of health and safety legal obligations, and they often do not realise the dangers of poor safety practice (Garengo *et al*, 2005). McKinney (2002) asserted that 'small companies usually do not think about the benefits of good health and safety practice and have insufficient resource to devote to health and safety'.

However, there is some indication that if appropriate Safety Performance Measurement (SPM) mechanisms are put in place, regardless of the size of organisations, adverse safety incidents can be reduced to a minimum level. Engasser (2010) stressed that 'every accident is preventable, if there is candid desire to uphold high safety standards'. Undeniably, 'large construction companies are getting it (good safety performance) pretty much as they should do, because they put a lot of effort into selection, monitoring, measuring performance and they do not tolerate low standards ... however the fact remains that it is really difficult to reach firms at the SME end of the industry' (Berkin, 2012). A recent report by the Small Business Advisory Group (SBAG 2012) highlights that the construction industry should not shy away from the fact that small business safety performance is often second-rate mainly due to a lack of knowledge, lack of manpower and unclear regulatory rules surrounding health and safety management. The OECD (2008) affirms that the key to successful management of health and safety in large organisations is nothing more than good implementation of SPM, which entails 'benchmarking safety best practice, operating with clarity, certainty and the promotion of continuous improvement principles'.

Arguably, it is inherently difficult to involve SMEs in SPM; however, some of those that are involved are usually ignorant of what to measure (HSE, 2001). Many safety analysts are of the view that the concept of measuring safety performance is often mis-prioritised by small firms who usually base SPM on the traditional approach; probably measured on percentage profit, return on investment, absence of accidents and turnover (OECD, 2008). The HSE (2001) asserts that large companies equally make the mistake of measuring their safety performance on the basis of the positive nature of zero accidents, rather than from the negative premise of reflecting on failures. Garengo *et al* (2005) identified that the nature of SMEs and their sensitivity to differences in managerial culture and management systems, invariably makes this category of firms underestimate the value of the measurement of safety performance.

The HSE (2001) stresses that if well-implemented, effective SPM systems create awareness and help firms to assess whether safety-related actions (procedures and practices) are achieving their desired results. In addition, such measures help organisations to understand their level of health and safety attainment and whether

safety-related actions are leading to lower likelihood of accidents occurring and/or lower adverse impact on human health. Above all, there is a strong indication that SPM helps small firms to be proactive in their efforts to reduce the likelihood of accidents and to improve preparedness and response capabilities rather than being reactive (Bibbings, 2003).

Literature

The overwhelming majority of the UK and Europe construction businesses are SMEs. Hitherto, research into SMEs was often considered problematic due to their social characteristics and the dynamics found in small businesses, which are commonly linked to contradictory outcomes for health and safety (Deighan, 2009). Small enterprises have notable difficulties upholding high health and safety performance standards (McKinney, 2002; Fairman and Yapp, 2005). In specific terms, the European Agency for Safety and Health at Work (EASHW, 2004) highlighted that resources and time are the greatest barriers to attaining high safety performance in SMEs. The need for good safety performance makes more economic and moral sense to SMEs, because most employees, who are often victims of unsafe practices, are either relatives of small business owners or family friends (OECD, 2010). Therefore, incompetence and ignorance should not be seen as an excuse by SMEs for safety non-compliance; rather small firms should consider SPM as a key step towards safety management improvement. The saying ‘you cannot manage what you cannot measure’ simply attests to the need for SMEs to take SPM seriously. SBAG (2012) restated that ‘SMEs’ future performance challenges rest purely on the need to be nimble, flexible and adaptable to positive safety culture’ that can be self-evaluated. Thus, construction entrepreneurs saddled with day-to-day running of high risk businesses need to constantly ask themselves ‘where are we and why?’ SMEs need to be aware that the need to implement SPM is required not only to save lives, but it is inextricably linked to their financial performance (HSE, 2001).

Definitions of SMEs and SPM

It is quite difficult to define and classify enterprises that do business in the construction industry. At best they can be categorised using the wide-ranging industry classification based on the European Commission for Enterprise and Industry’s (ECEI, 2011) definition of ‘enterprises’. The OECD (2010) and (ECEI, 2011) put forward a statistical table. Their tabulation suggests there are four types of enterprise: large, medium, small and micro, as illustrated in table 1. Most literature identifies that the underlying mechanism, which could predict whether SMEs are likely to have the desired SPM standards has not been systematically examined (OECD, 2008; SBAG, 2012). Although research by HSE (2001) and Deighan (2009) looked into psychological and cultural factors of SMEs, little or no study appears to measure small business safety performances against good safety practices in large companies, bearing in mind that SMEs are more involved in adverse safety incidents in the construction industry.

Table 1: Classification and definition of SMEs adapted from ECEI (2011).

Enterprise category	Headcount	Turnover	or	Balance sheet total
Large company	>250	> € 50 million		> € 43 million
Medium-sized	< 250	≤ € 50 million		≤ € 43 million
Small	< 50	≤ € 10 million		≤ € 10 million
Micro	< 10	≤ € 2 million		≤ € 2 million

The phrase ‘SPM’ is used to mean observable health and safety measures that provide insights into how safety activities are carried out (OECD, 2008). SPM simply involves processes/strategies in place for collecting and reporting information regarding the performance of health and safety in organisations; it also examines whether safety outcomes are in line with what was initially intended (HSE, 2001). Arguably, it is quite difficult to measure directly the health and safety performance of enterprises for the reason that health and safety differs in many areas of performance measurement; successful results are often based on the absence of an outcome (injuries or ill health) rather than measuring present effort put into safety management (HSE, 2001). But a low injury or ill-health rate, even over a period of years, is no guarantee that risks are being controlled or will not lead to injuries or ill-health in the future (Garengo *et al*, 2005). However, there are a number of observable parameters or balance system dynamics, known as Safety Performance Indicators (SPIs), that can be put in place to support good SPM decision-making processes; these entail gathering and analysing safety information that complies with required safety standards (HSE, 2001). A good SPM process should follow a simple format, as illustrated in figure 1.

Hudson and Stephens (2000), in an article entitled ‘Only just managing – no time to measure’ affirm that effective SPM must be strengthened by a ‘plan-do-check-act’ measurement process. The OECD (2008) further argued that SME entrepreneurs must consider health and safety management systems in the same way as financial and production matters. SPM must be based on policy development, anchored on a feedback loop that improves performance. Any meaningful safety performance measurement must also be anchored on a basic strategy of policy development, effective organising, auditing, planning and implementation, measurement and review of performance (HSE 2001).

The OECD (2008) opined that there are basically two types of SPM: outcome indicators and activities indicators:

- Outcome indicators are strategies employed by large firms to help assess whether safety-related actions (procedures, practices and policies) are accomplishing their desired result. They are reactive, intended to measure the impact of actions that were taken to manage safety, and are similar to what is called ‘lagging indicators’ in other documents. Outcome indicators often measure change in safety performance over time.

- Activities indicators are usually designed by enterprises to help identify whether they are taking actions deemed necessary to lower risks. Unlike outcome indicators, activities indicators are proactive measures. In most literature, activities indicators are often referred to as ‘leading indicators’ (OECD, 2008). They often measure safety performance against a tolerance level that shows deviations from safety expectations at a specific point in time.

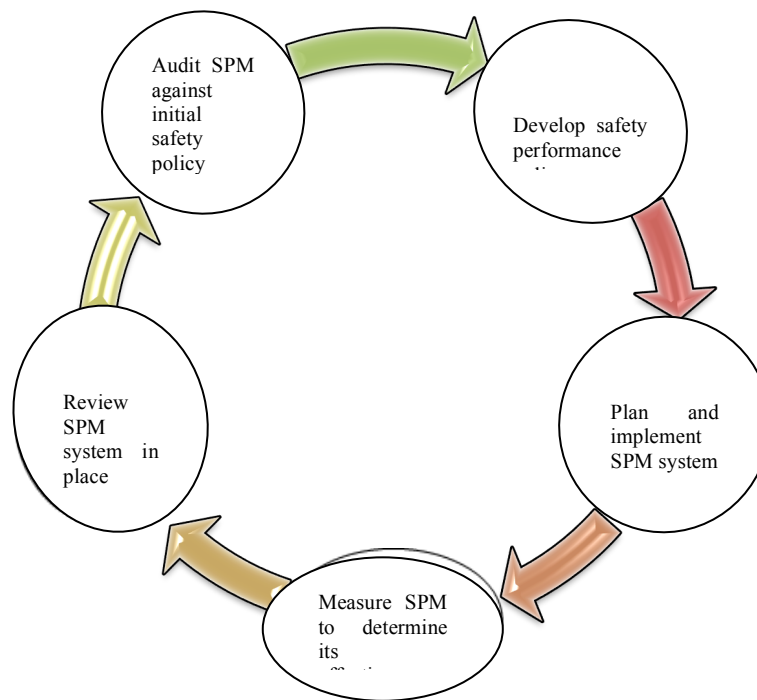


Figure 1: Safety performance measurement plan, adapted from HSE (2001)

Where is the construction industry in terms of SPM targets?

The need for effective SPM systems in construction can be likened to the maxim that ‘if people (organisations), do not know where they are going, chances are they will end up somewhere else’. In terms of safety targets, the Construction Industry Advisory Committee (CONIAC, 2002) reported that the industry set for itself long-term safety performance targets in February 2001 to improve its health and safety record. The targets set by CONIAC were aimed at reducing fatalities by 40% over five years and by 66% over ten years (CONIAC, 2002), as illustrated in table 2.

However, these targets were generally considered to be too ambitious, compared to the UK government’s target set in the year 2000 for a 10% reduction in fatal and major injuries over a period of ten years for the whole industry. Findings by the House of Commons Committee on Public Accounts (HCCPA 2003/04) reveal that ‘attainment of safety performance targets in construction by 2009/10 would only see the sector’s fatality and major accident rates falling to levels which other industries achieve currently’. The HSE (2010) considered the industry targets to be sufficiently challenging, though there is widespread belief that large companies operating in the industry were essentially more committed to meeting these safety targets compared to most SMEs, which are known to be very lax in their health and safety responsibilities.

Table 2: The construction industry's targets compared to national health and safety targets. Adapted from the National Audit Office (NAO/HCCPA 2003/04 analysis data (Ev 19–25)

Target	Construction industry targets - percentage reduction		Percentage reduction for construction industry	National targets - percentage reduction	
	By 2004/05	By 2009/10	As at 2002/03	By 2004/05	By 2009/10
To reduce the major incidence rate of fatal and major injury accidents	40%	66%	5% against baseline figures for 1999/2000	5%	10%
To reduce the number of working days lost per 100,000 workers from work-related injury and ill-health	20%	50%	Baseline figures were established in 2001/02	15%	30%
To reduce the incidence rate of cases or work-related ill-health	20%	50%	Baseline figures were established in 2001/02	10%	20%

Using the 2001 safety performance targets as a reference, the HSE (2012) acknowledges that in all, there has been a significant reduction in the number and rate of injuries in the last 10-20 years up to 2011/12, but construction still accounts for 22% of fatal injuries to employees and 10% of reported major injuries. The rate of fatal injuries in 2012 is a performance achievement of 33% compared to the construction industry's 2009/2010 safety performance targets of major incidence rate of fatal and major injury accidents.

Furthermore, safety performance measurement figures based on working days lost per 100,000 workers due to work-related injury and ill-health in 2012 show room for improvement as do those for fatal injuries. For instance, HSE (2012) statistics reveal that, 'there were 5,391 reported over three day injuries to employees in 2011/12p, compared to an average of 6,427 over the previous five years. The corresponding rates of over three day injury per 100,000 employees were 415.4 in 2011/12p and an average of 418. As with major injuries there has been a general reduction in the rate of reported over three day injuries since 2004/05. The number of reported injuries has also fallen significantly since 2007/08, though there was slight increase in 2011/12p.

Perhaps reasons for not attaining safety performance targets can be traced to the OECD (2010) assertion that the scope and cost of compliance with health and safety regulations is on the increase, and larger construction firms appear to have firm control over safety budget systems or spending on preventive safety measures in their contract bids. As such, large firms have a better chance of managing health and safety to required standards. On the other hand, the way in which most SMEs operate is more likely to create an oversight or complete exclusion of preventative safety incentives in tendering documents. For instance, most SMEs are most likely to cut health and safety preventative working from their tender documents in order to secure contracts. Pieron (2010) in an article 'Why Cost-Cutting, Safety may cost you more'

argued that often the first things to bite the dust in a slow economy are safety incentives and maintenance programs'. Business owners and managers just cannot see that spending money on a safety officer or safety training for employees when cash is tight and they need to buy materials. Small companies, even those with good accident records, can be much more vulnerable to the costs of safety program deficiencies than large ones. Thus, lukewarm attitudes to spending on preventive safety measures leads small companies to cut corners and to be thus vulnerable to accidents.

Recent findings by SBAG (2012) confirm that SMEs' failure to uphold safety best practice in the workplace is mainly caused by cost-related constraints. Pieron (2010) highlighted other factors such as difficulty recognising basic health and safety regulations by SMEs and micro firms, lack of understanding, mis-interpretation of safety regulations and unwillingness to report anxiety, as well as not communicating with safety regulatory authorities. Walters (2001) argued that SMEs and micro firms have low collective strength and little or no union representation, thereby hampering the efforts of regulatory authorities in reaching out to them. In most cases, SMEs are at a disadvantage in terms of having little likelihood of inspection by the safety regulatory bodies and many understand that the HSE is unlikely to reach their areas of operations. Thus, small and micro firms are time and again tempted to engage in safety sharp practices or underhand behaviour.

McKinney (2002) argues that among enterprises doing business in the construction industry, SMEs and micro firms usually give low priority to health and safety best practice in the workplace: 'SMEs tend to underestimate the risks posed by their workplace. In most cases, indifferent attitudes of managers to health and safety are reported by employees and intermediaries'. Regulations are viewed by this type of firm as overly complex, and health and safety is not recognised as a key business objective. For instance, SMEs and micro firms are reluctant to contact the regulator for assistance for fear of prompting an inspection. This 'fear factor' has been well identified in the published literature (Yapp and Fairman, 2006). The concern may be well-founded, and a pointer as a major reason why construction has not fully met the set safety performance targets since 2001 (Garengo *et al*, 2005).

Methodology

The research methodology is based on a qualitative research inquiry, in order to have an in-depth examination of the research problem, and to have full insight into how experienced practitioners in the construction industry (research participants) view construction industry safety performance. Long qualitative interviews were conducted with twelve industrial practitioners and two academics, as illustrated in table 3. The conversations were recorded using a digital tape recorder. The interview discussions were later transcribed to ensure that all conversations are fully captured, readable and to show the intonation of every conversation (Jefferson, 2004). The decision to use the Jefferson system of transcription was to ensure that the transcribed data conform to standard conventions to represent features of conversation, emphasis, commas, overlap or pauses.

A semi-structured interview approach was used, with a list of definitive questions and pre-prepared questions to enable the researcher to probe and ask the participants for more detail about the research problem (Farrell, 2011). The transcribed data were subsequently analysed using Nvivo 9 software to filter and sort findings. The analysis

started by coding of the data and it was done as an antecedent to examination rather than analysis itself. The data coding was particularly important because it helped in the preparatory process; it was carried out independently on all data sources due to varied nature of interviewees' experience to the research topic or various accounts of the interviewees. In all, the entire methodological process was driven by inclusiveness of keywords, terms, phrases, ideas, concepts, themes and topics surrounding the research question to enhance reliability and validity.

Table 3: Category and number of participants involved in this study

	SMEs	Large construction firms	Government bodies (Constructing Excellence and HSE)	Academics
Respondents' Positions	Managing Directors	Senior Construction managers, QS and Senior Site Agents	Executive Director of Constructing Excellence, Director of Health and Safety Olympic Delivery Authority (ODA) and HSE enforcement officer	A Professor and a Senior Lecturer in Construction Management
Number of respondents interviewed	4	3	3	2

Findings

For clarity, understanding and greater spontaneity of the interaction between the researcher and the study participants, some textual contents were trimmed from the transcribed audiotapes and field notes to enhance readers' understanding of findings. Findings show that virtually all participants cited inadequate capital (lack of spending on preventative safety incentives, insufficient safety budget) as critical factors mitigating against good safety performance in SMEs and micro firms. However, on a general note, health and safety performance in the construction industry is viewed as very good. In fact, there is an unanimous view with regard to general health and safety performance standard across the industry. The industry tends to show a significant improvement in safety performance compared to ten years ago. For instance, when participants were asked to describe broadly health and safety performance in the construction industry, their responses highlighted impressive improvement. Some of the textual content responses to general safety performance in the industry are highlighted as follows:

'It is actually difficult to measure health and safety performance, at the same time I am not saying the overall safety performance is bad ... I think the industry has gone beyond compliance with basic safety laws to achieving higher standards' (Senior Health and Safety Officer in the Olympic Delivery Authority 2012)

'Within the UK, I think that compliance or safety performance standards are very good' (Executive Director of Government representative body)

However, further probing of the research participants about what they claim to be very good health and safety performance in relation to the chronic adverse safety incidents in the construction industry reveals that, in a broad sense, participants were actually referring to large construction companies' performance being very good compared to SMEs. For instance, when participants were asked 'if you say health and safety performance is very good in the industry, how would you correlate your response (very good) with safety statistics that portray the construction industry as one of the most dangerous industry in the UK, especially when 48 people have lost their lives annually on average in the past five years?' Participants responded thus:

'if we examine carefully safety statistics, we must accept that a lot still needs to be done by SMEs and micro companies in terms of safety performance, ... overall, I will say very good, but not excellent' (Construction Manager in a large construction company)

'If we are to generalise, I think the main contractors, I mean the larger firms, seem to have better compliance picture in terms of health and safety compared to SMEs' (Senior Site Agent large construction company)

Yet, the SMEs whose safety performances are being questioned, agree that there is more to be done to improve their health and safety performance. For example, the view of one small business owner is expressed as follows:

'I think safety in construction is still very good ... irrespective of those woeful safety statistics. Though, I must admit that there is still some systematic neglect of health and safety, especially by small companies' (Managing Director of a small construction company)

Subsequently, when participants' views were sought concerning why the construction industry is in its present state in terms of health and safety performance their responses varied significantly, with explanations relating to SMEs' characteristics, fragmented nature of the entire industry, SMEs' poor project costing culture, and so on. Some of the explanations proffered by participants are highlighted as follows:

'... to me the reason we have higher casualty rates in the construction industry compared to other industries is mainly because of the procedures involved in the management of health and safety in terms of construction site specific, which are quite different from other industries' (Professor of Construction Management)

'Basically, the bulk of the health and safety problems in the construction industry can be traced to small companies; and the primary problem with SMEs is money' (Senior Quantity Surveyor of large construction company)

'I think the major influence is the pressure of finance on SMEs' (Senior Site Agent of a large construction firm)

'I think cheaper prices involved in getting them (SMEs) and poor business evaluation analysis make smaller companies cut corners which are the non-adherence issues' (Managing Director of a small construction company)

'Some (SMEs) may not be concerned with the reputation of their business; ... ehmm ..., I think the main issue is cost (money) ... involved in providing health and safety as required - may be SMEs' main reason' (Government body representative)

'... we should know that managing health and safety requires maintaining set standards; and could be quite expensive for SMEs in terms of management, material, skills, and so on. Large firms definitely will be better off in providing good safety compare to smaller firms' (Professor of Construction Management)

'I know things are pretty difficult at the moment and some of these smaller firms (for money reasons) will do anything to get a job, thereby putting themselves at risk in the course of executing the job' (Senior Site Agent of a large construction company)

'There is that tendency for SMEs to negotiate work with clients who probably do not know that they have to include or make provision for health and safety and some small companies do not normally face up to such responsibility' (Senior Health and Safety Officer in the Olympic Delivery Authority 2012)

Discussion and conclusion

It can be deduced from this study that generically the construction industry as a whole has come a long way in improving health and safety in the workplace. Content analysis of data obtained in this study shows that health and safety performance in large construction firms may be considered excellent, and some participants even suggest that perhaps there is not much more that can be done to secure further improvements. There is the inference that large construction companies have bespoke means of budgeting money for health and safety in tender documents; which helps to improve SPM systems, and the control and monitoring of entire safety activities. Small companies can 'take a leaf' from large companies in this respect.

Participants suggest that SMEs operating in the industry still account for the bulk of poor safety performance and hitherto represented a threat and bad image for the entire industry. Virtually all participants interviewed agreed that financial pressure remains the greatest threat to SMEs' safety performance. Other factors, such as the fragmented nature of small firms, poor contract negotiations, ignorance and insensitivity to business reputation by SMEs, were also identified as reasons. Garengo *et al* (2005) argued that performance measurement implementation in SMEs rarely had a holistic approach. Indeed, most SMEs do not really have integrated safety performance measurement systems. The HSE (2001) further argued that most SMEs are not even aware of safety performance models. For SMEs to overcome pressure of finance there is perhaps the need to have robust, bespoke means of budgeting money for health and safety and to have harmonised pricing mechanisms. The HSE needs have a more effective strategy to monitor, reach out to and train SMEs. It should be acknowledged that SMEs are not generally opposed to the idea of attaining good safety performance; what seems to be lacking for small businesses operating in the industry is help to understand their problems. In this regard, there is need for further research in the areas of developing new ways to reach out to SMEs and of identifying barriers to improvement.

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Tall Buildings Legislation Impact on Quality of Urban Life in Doha Towards Form Based Codes (FBC)

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Abstract

Doha has undergone massive changes in economics, physical form, and population in the past few years. Through Doha's globalization, the government approved a handful of tall buildings to be built in West Bay area, a new business district in Doha. Unfortunately, there were no Legislations to regulate the design of these tall buildings or ensure their contribution to the quality of urban life. As a result, we have a bundle of eye catching towers that shapes the city skyline beautifully but without taking in consideration their impact on the quality of urban life. This paper studies the impact of tall buildings on quality of urban life through analyzing a case study from West Bay area that addresses the problem. The analysis of the case study is based on observations that monitor social and environmental behavior. The paper proposes solutions using form-based codes. These codes concentrate first on the visual aspect of development then the relationship of the buildings to the street and to one another. Form-based should be later on integrated to Legislations that regulate planning and ensure better quality of urban life.

Keywords

Form-based codes, Iconic architecture, Quality of urban life, Tall buildings, Urban re-imaging.

Doha's evolution toward globalization

Qatar has prospered in the last several years with continued high GDP growth in 2011. Qatari authorities throughout the financial crisis sought to protect the local banking sector with direct investments into domestic banks. GDP rebounded in 2010 largely due to the increase in oil prices, and 2011's growth was supported by Qatar's investment in expanding its gas sector. Economic policy is focused on developing Qatar's non-associated natural gas reserves and increasing private and foreign investment in non-energy sectors, but oil and gas still account for more than 50% of GDP, roughly 85% of export earnings, and 70% of government revenues. Oil and gas likely have made Qatar the second highest per-capita income country - behind Liechtenstein - and the country with the lowest unemployment. Qatar's proved reserves of natural gas exceed 25 trillion cubic meters, more than 13% of the world total and third largest in the world. Qatar's successful 2022 world cup bid will accelerate large-scale infrastructure projects such as Qatar's metro system and the Qatar-Bahrain causeway (Forbes, 2012). This economic prosperity that the country enjoys allows it to establish high standard construction projects in a very fast pace.

High tech buildings are constructed effortless and in no-time putting the country in a fast urbanization stage.

Population growth trend

Recently in 2010 census the number of the total population is 1,699,435. The composition of the overall population of the country in 2010 is 76% males and 24% females. The total population has increased by 128% since 2004 (QSA, 2010). According to the census, most of the population is concentrated in the inner parts of Doha. After the population growth boom in 2006 population started to expand in all directions generating from the center of the city. The fast urbanization Doha was witnessing needed establishing housing projects and related infrastructure. Also, it is important to mention that 75% of Qatar population are non-Qatari.

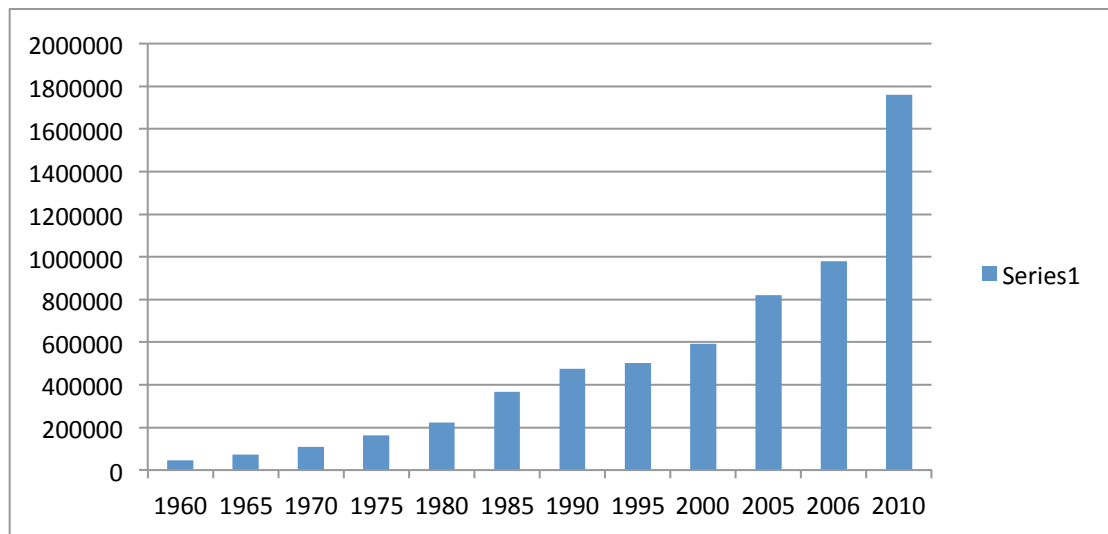


Figure 3. Qatar population growth trend. (World Data Bank, 2013)

Planning, as a Western concept, began in Qatar at the beginning of the nineteen seventies. Qatar invited the planning company of Llewellyn-Davies, Weeks, Forestier-Walker, and Bor to send a team to begin the process of developing a plan for the State. The plan was strategic and had the intention to produce goals, objectives and standards that would enable the State to move forward within a sensible and sensitive framework for decision making. The central area (the old downtown of Doha) was becoming too old and rickety to develop. The government took the decision to dredge West Bay area and reclaim it for future developments. By 1975 the planning agencies, produced the Concept Plan, which provided the outline for development of this area. The elements that were to be located in this area, now known as the New District of Doha – but by some as the West Bay or the Dafnah-were: Qatar University- a regional park- Senior staff housing- Intermediate staff housing- a 500 bed hotel and conference center- a diplomatic area- a ministries area- a district center- and central business district" (Lockerbie, 2013).

The New District of Doha was an opportunity to establish high standards of design and construction within the State (Lockerbie, 2013). It was sufficient to have ten to twelve building stories to include all business activities in Qatar and satisfy the country's population and economic boom. However, the state's inspirations and

ambitions was to re-image the city skyline with iconic towers. These iconic towers helped the state in taking their position in globalization.



Figure 4. The reclamation of West Bay area, new shore line, and Master Plan.
(Lockerbie, 2013)

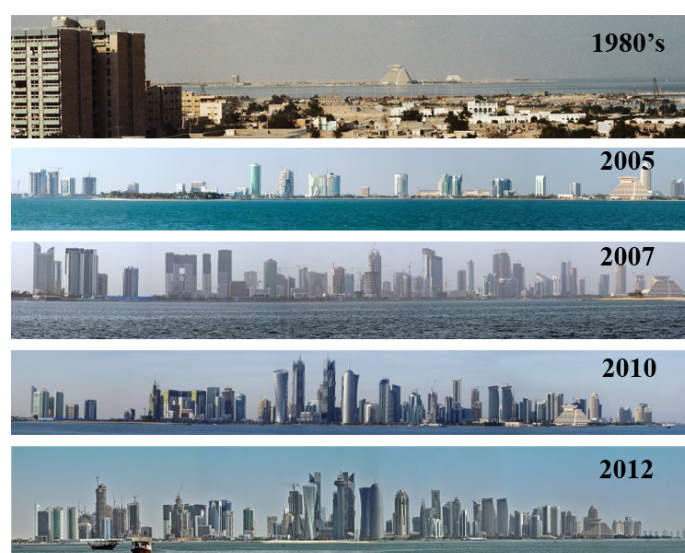


Figure 5. Doha's changing skyline from 1980's to 2012. (DesertBlooms, 2011)
(Thompson, 2012)

Problem statement

A damaging aspect of the tall building is how it meets the street where blank walls and security gates destroys the street life (Rangwala, Contextual Tall Buildings in India, 2010). The debate is no longer about whether we need tall buildings or not. The arguments now are about location, design, architectural qualities, and their sustainability (Charney, 2007). However, no one ever talks about the urban habitat and how this tall building existence will affect the life of individuals in a positive or negative way. In the case of West Bay, the goal was to take care of the “above the base” part to achieve the iconic effects of skylines and towers without paying attention to the impact of the building on the ground level or street level. Urban designers provide beautiful landscape or efficient parking in the surrounding context, regardless the necessity to have livable urban space that can enhance an individual well-being. The problem is not summing up a number of ingredients to have a sustainable building. The problem is how mixing those ingredients can add value. Most of the times it ends up having a sustainable certified building that is not

sustainable in its context, harming quality of urban life on the ground level despite that they form a bundle of iconic buildings with dead, isolated, and deserted spaces between them.

The literature in this study is based on three pillars. First, tall buildings were most of the literature see tall buildings as a phenomena that destroys human scale, environmental, and social sustainability of the society. Only few articles talked about the importance of tall buildings in imaging and branding cities. Second, quality of urban life which is a concept that became important recently after the negative consequences of the industrial revolution. Most of the literature gives different definitions for the quality of urban life and states different assessing models. Third, form-based codes which is a new technique that indicates codes that helps in sculpturing the outdoor environment through the surrounding building form.

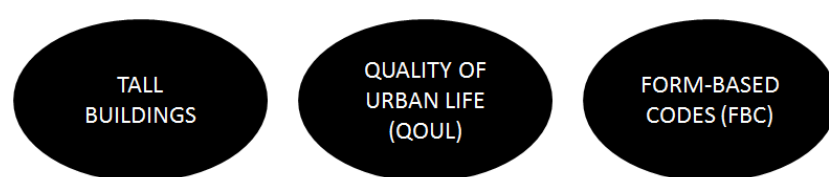


Figure 6. Literature review composition. Source: author.

Tall buildings:

In his article (Charney, 2007) “The politics of design: architecture, tall buildings and the skyline of central London”, Talks about the time when London started to build tall buildings at 2000 and how they used tall buildings as iconic architecture for urban re-imaging of the city and the importance of high quality design. Tall buildings often involves global architects and iconic architecture as they promote development, and that political leaders appreciate the instrumental role of architecture as an expressive means of urban re-imaging” (Charney, 2007). The government eventually approved the construction of tall buildings in central London as it is linked to global city status and having spectacular tall buildings. The debate was no longer about if we need tall buildings; arguments instead encompassed issues such location, design merits, and architectural quality” (Charney, 2007). So by evaluating other cities practices he concluded that spectacular and innovative architecture designed by star architects positively contributes to the exposure of their cities. Another article “Visual and cultural sustainability: the impact of tall buildings on London” (Travenor, 2007), Discusses the need for tall buildings to have compact and sustainable development and its impacts visually and culturally. Travenor says “sustainable development should improve the quality of the existing environment, attract business and investments, and reinforce a sense of place and civic pride” (Travenor, 2007). He talked about planning policy general guidance PPGG of London which stressed on the role of design in planning, the importance of spaces between buildings, and defined what is good design and its importance. He also talked about the impact of the surroundings on the quality of urban life and how the improvement of built environment brings social and economic benefit for local communities. In his article “Public: The forgotten realm” (Rangwala, Public: The Forgotten Realm, 2010), he describes how buildings form public realm and affect its livability. Rangwala says “in case of tall buildings, they are designed as freestanding icons in green buffers or

parking lots, above the base the building can be iconic and the base should be scaled to human beings” (Rangwala, Public: The Forgotten Realm, 2010).

Quality of urban life (QOUL)

In his book “Investigating quality of urban life: theory, methods, and empirical research” (Marans & Stimson, 2011), defines quality of urban life as the satisfaction that a person receive from surrounding human and physical conditions. He highlighted the importance of investigating the QOUL in affecting the livability of cities. Marans divided the QOUL into two approaches; the objective approach as geographic data, and the subjective approach as behaviors of people. Marans says: “The measurement and the assessment of Quality of Life (QOL), and the investigation of its effects on human behavior are increasingly important topics within the social sciences, where QOL is the satisfaction that a person receives from surrounding human and physical conditions, this definition accurately reflects Quality of Urban Life (QOUL). Investigating QOUL is important not only because it affects how people behave but also their life satisfaction and happiness, it can also directly affect the livability of cities for residents and provide a set of matrices which allow policy makers and planers to assess the effectiveness of their efforts (Marans & Stimson, 2011).

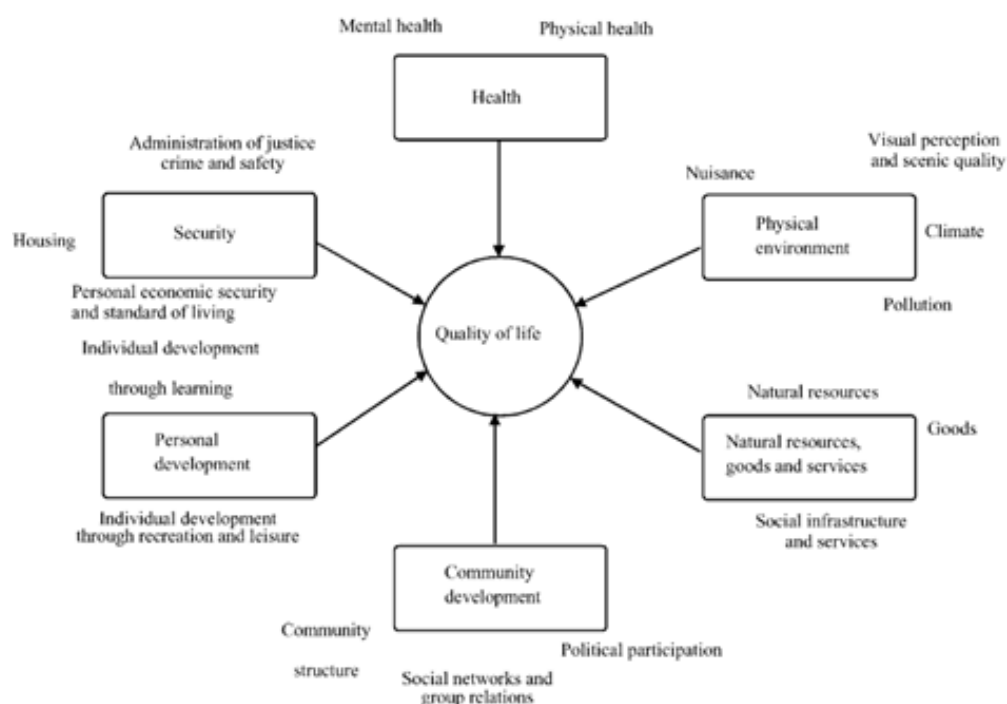


Figure 7. Quality of Life components. (Marans & Stimson, 2011)

A literature study “Urban environmental quality and human well-being towards a conceptual framework and demarcation of concepts” (Kamp, Leidelmeijer, Marsman, & de Hollander, 2003) states many models created to investigate QOUL and determination of aspects affecting it. According to their model for having livable urban spaces with good QOUL, some aspects must be considered as the community should be user friendly, environment should be viable, and economics should be movable, all of this to obtain livable, accessible, and sustainable Quality of Urban Life. The authors say “Urban spaces as neighborhoods, centers, and corridors are

simply great places, which foster social interaction and a sense of community. These types of developments tend to attract financial investments overtime and become sustainable” (Kamp, Leidelmeijer, Marsman, & de Hollander, 2003)

Form-based codes

Form-based codes address the relationship between building facades and the public realm, the form and mass of buildings in relation to one another, and the scale and types of streets and blocks. The presentation of regulations and standards in form-based codes are in both words and clearly drawn diagrams and other visuals. Form-Based Codes report contains: Purpose & intent- regulating plan- street scape standards- building standard. Moreover, some additional standards are optional as: architectural standards- landscaping standards- signage standards- environmental standards, Form-based codes commonly include the following elements: Regulating Plan, Public Space Standards, Building Form Standards, Administration process, and Definitions. Form-based codes may also include: Architectural Standards, Landscaping Standards, Signage Standards, Environmental Resource Standards, and Text and illustrations explaining the intentions of code provisions (FBCI, 2010). Again (Rangwala, Contextual Tall Buildings in India, 2010) in his article “Contextual Tall Buildings in India”, describes Form-based codes (FBC) “make the good easy to build”. He states that these development regulations produce predictable built results and a superior public realm by using physical form as the organizing principle. He says “FBCs are graphic-based codes that allow the public to visualize in advance the form and location of the streets, buildings, and open spaces leading to a higher comfort level with taller buildings. FBCs require far less discretionary review and process, which saves everyone time, money and effort” (Rangwala, Contextual Tall Buildings in India, 2010).

Methodology

The research depends on studying two tall buildings in West Bay area and analyzing their impact on the quality of urban life in the surrounding area. Gathered data are qualitative which is more appropriate to the nature of the study than quantitative. Data was gathered in different days of the week through observations to ensure the correctness of the results.

Research design

The research starts with an introduction about Doha and what is the economic position of the state. It is important to know that Doha was a low rise city until the establishment of the new business district in West Bay. the introduction of high rise building opened the door for further development. Iconic towers with the signature of well-known architects put Qatar on the road of globalization and city branding. The lack of tall buildings construction legislation and the lack of knowledge of how buildings can affect the quality of built environment led to having a bundle of eye catching towers regardless their effect on the quality of urban life. Observations were carried out to investigate the situation in West bay area. After studying the observations results, form-based codes were formulated to solve the issues. These form-based codes can be easily transformed into legislations to control tall buildings construction and assures the quality of urban life in the area.

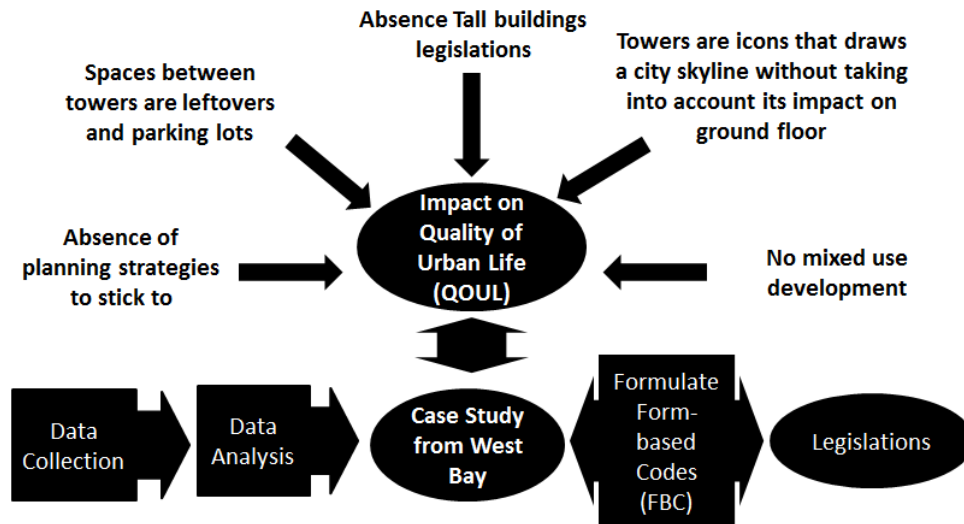


Figure 8: Research design process. Source: author.

Data collection

Primary data was collected through field surveys, site visits, and observations. The collection of data was in the form of notes, drawings, and photos. Surveying the space was not an easy task as these spaces were empty from people, which was not safe. Properties are fenced and hardly accessed for taking photos. However, taking photos from outside was suitable for the research as it is concerned with the surrounding.

According to planner Paul Crawford, one of the experts of form-based codes, the typical data that required to prepare the codes include:

- 1- Street types (by setback, walkway, roadway, and landscape,
- 2- Building types (footprint, profile, street front, access by car or pedestrian, service areas),
- 3- Open space types (front, back and side yards, squares and parks, undeveloped parcels with urban zoning),
- 4- Parking types and location (parallel, diagonal, lots),
- 5- Natural features (creeks, significant trees, views, hills, etc.). (Crawford, 2010)

Secondary Data was collected through articles, researches, and books that discuss the research problem. Mainly through the internet in the form of PDF and WORD documents. There were a lot of researches, articles, and books discussing tall buildings, quality of urban life, and form-based codes individually, or in a combination of only two topics, but only one article that discussed the three topics in a whole.

The Case Study: Regency residence & Al-Sara residence West Bay area- Data Collection

Regency Residence and Al-Sara residence are residential towers in the West Bay area. West Bay area is a new mixed-use district that has a loose urban fabric and not yet congested. The choice of the buildings depended on their location, height, and surrounding land use. Fig. 7 shows the location of the case study close to the Cornish line and the city center mall giving them an opportunity to create a healthy and attractive environment. The towers enjoy the view of Doha's Cornish. Fig. 8 shows the setbacks, where front yards are used for building and parking. Parking is either on-

site or underground. Regency residence backyard has a restaurant (opening soon), and a small playground for the children. Al-Sara residence backyard is empty. Fig 9 shows the building profile and its weak relation with the surrounding. The building does not have a role in shaping the outdoor space around it.



Figure 9. Location of the case study. Source: author.



Figure 10. Backyards for Al-Sara, and Regency residence. Source: author.

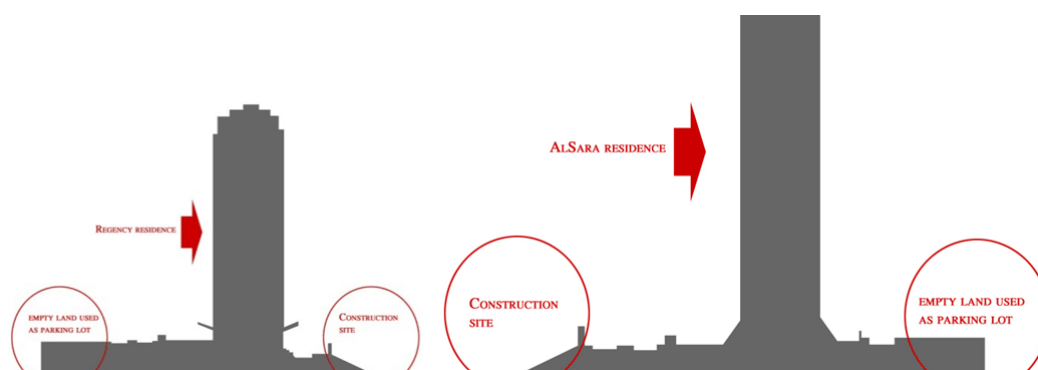


Figure 11. Buildings profile. Source: author.

Data analysis (observations result)

The main purpose of observations is to analyze people's behavior and how they interact with the environment around the case study. Unfortunately, there were few people to observe, some security men on gates and tower's residents leaving the buildings to their cars. Tower residents take their cars to perform the simplest day activities as buying groceries. As shown in fig. 10 spaces are empty from people even the children's playground in Regency residence. Fig. 11 shows that activities are walled and cannot be accessed by public or even neighboring towers. Disconnected

spaces weaken the relation and interaction between residents in both towers. This disconnection destroys the sense of community which eventually affects the quality of urban life. Barriers, walls, and disconnection between spaces affect individuals psychologically. Naturally People tend to socialize and interact, the case here is that the built environment prevented people from having this opportunity.



Figure 12. Emptiness of spaces surrounding the buildings. Source: author.



Figure 13. Children's playground and the opening soon restaurant –walled activities and disconnected open spaces. Source: Author.

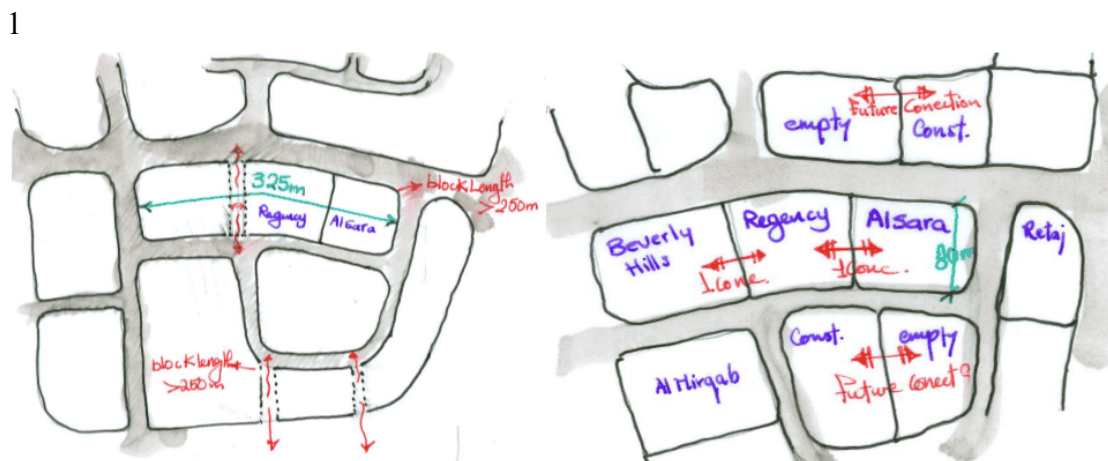


Figure 14. Block length standards and Proposed interconnections. Source: author.

Applying Form-Based Codes FBC on the case study (The Research Result)

Intent: facilitating interconnectivity and vehicular movement.

1. In order to facilitate pedestrian movement, dispersion of traffic, and delivery of emergency, block lengths should be limited, and streets should be interconnected.
2. Developments should provide interconnections with adjacent properties. This will facilitates pedestrian and vehicular circulation.

Standards

- Maximum block length= 250m for residential, 125 m for retail, and 250 m for offices.
- Interconnectivity: no cul-de-sacs, or looped streets.
- One connection with a property that has at least 50m of common property line.
- One connection for each 350 m or portion of common property line.

Intent: enhancing the sense of community and livability of spaces.

1. To enhance a sense of community, social interaction, and strengthen property value by having a pocket of open space.
2. Streets should be located to provide views to open spaces, landmark buildings, and views to build community character and sense of neighborhood.
3. Mixed use developments: developments should have residential with either retail or offices mixed vertically or horizontally with a high degree of pedestrian linkage and amenities.
4. Create attractive and successful retail that contribute to the pedestrian environment.

Standards

- Minimum size of Open spaces should be 15-20m wide. All adjacent projects or across the street must face directly to the open space.
- All public spaces shall have at least one street on one of its sides and to be designed according to CPTED (Crime Prevention Through Environmental Design) guidelines for the design of open spaces to prevent crime.
- Views: plazas should have a focus such as a fountain or art work and contains shade such as trees.
- Developments should provide 4 sq. ft. residential use for each 1 sq. ft. retail use and a minimum area of 10% of total project area for mixed use, 20% for greater than 5 units per acre.
- Minimum of 10% of the project area shall be used as a public space/plaza. Uses must be vertically and horizontally integrated with pedestrian connections that do not cross traffic corridors or parking lot
- Ground floor height should be of minimum 5-8 m clear, where 60-80% of the ground floor facade should be clear windows.

- Setbacks should be minimum of 8 m from back of the curb and minimum width of sidewalk is 2m.

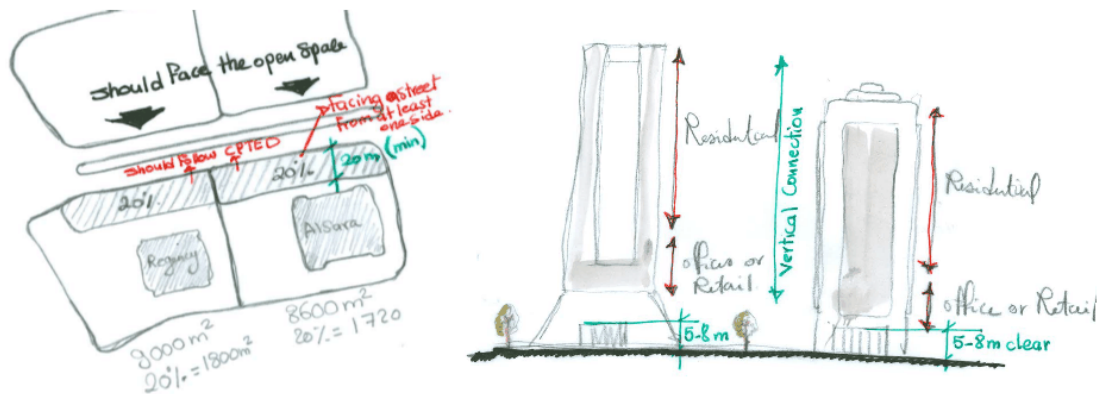


Figure 15. Enhancing the sense of community and promoting mixed-use developments. Source: author.

Intent: promoting pedestrian oriented community.

1. To create a pedestrian oriented retail center where the pedestrian environment is attractive and comfortable.
2. To enhance pedestrian orientation and reduce the need for large signage along the street.
3. To provide a pleasing articulated architectural form to the public environment and provide a healthy pedestrian district.
4. To provide a pedestrian oriented street without through traffic.
5. To create shaded, and attractive sidewalks that provide a feeling of safety in order to encourage pedestrian use.

Standards

- Parking should be located to the side or rear of the property behind the front building lines. Streets with no on-street parking a space of 1.8-2.2 m width for tree planting and lighting. Also, additional of 1.5-2 m may be added for outdoor dining patio or plaza.
- Sidewalks should be of minimum 2m clearance for pedestrians. Shade trees shall be planted along the street and within the parking area.
- Parking may be located in structured garages located in the property line. Properties on small streets or collectors are intended to be pedestrian oriented development and may construct on-street parking parallel or at 60° to the curb line.
- Tri-partite architecture: all buildings should be designed and constructed in tri-partite architecture, so they have a distinct base, middle, and top. Main entries should be highlighted, so they are obvious for pedestrians and motorists using building articulation and entry canopies. Each building must contain a functioning primary entry from the sidewalk.

- Windows and glazing should be a minimum of 30% up to 70% of each building elevation excluding retail.
- Street width must be a minimum of 6m with a parallel parking of 3m width. Street trees and lights must be on center every 15 m and 30 m respectively. Also, trees species should be specified.
- At least 50-60 m distance from building face to building face.

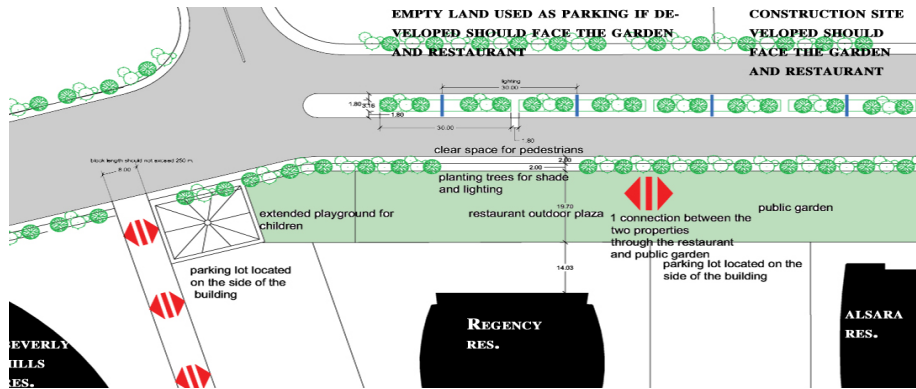


Figure 16. Form-Based codes REGULATING PLAN as designated for the area.
Source: author.

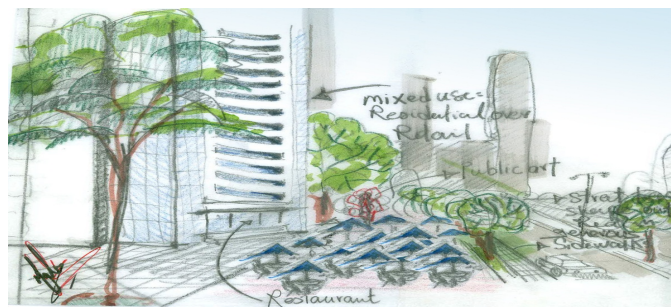


Figure 17. The area in front Regency residence after application of codes. Source: author.

Conclusion

As a conclusion of the research, there are two facts : first, quality of urban life could not be neglected as it affects the individual life and psychology. Second, construction of tall buildings will continue as long as the country is developing and globalizing. Tall buildings are more often about power; prestige, status and aesthetics. The solution for such problem is to construct those tall buildings in a frame of legislation that ensure the quality of urban life. Standard legislation could not ensure the quality, but form based codes encourages property owners to build in ways that further a community sense, particularly in terms of the design of the public realm. Tall buildings should have in their lower part a human scaled base or podium with some activities where public and the occupants of the towers can access. Taking care of the urban environment around buildings will minimize car usage and encourages people to travel by public transportation or even cycle or walk. Local authorities should carry out a detailed urban design studies that take into account historic context through a

character evaluation. In particular, these evaluations should identify: those elements that create local character and other notable features and constraints, including streetscape, scale, height, urban grain, natural topography, significant views of skylines, landmark buildings and areas and their settings, including backdrops, and local views, prospects and panoramas. Creating opportunities where tall buildings might enhance the overall townscape, or removal of past mistakes.

Recommendations

1. After the form-based codes are adopted it should be monitored, revised and re-integrated for future plans. The formulated codes for the case study should be integrated into legislation used later on for the construction of high rise buildings in the Qatar.
2. Form-based codes typically utilize drawings, diagrams and photographs. Codes in that form are much easier than putting them in a list with charts and formulas that dominate standard zoning practice. They further argue that people will more likely support what they can more easily understand.
3. Tall buildings design policies for having compact sustainable city should stress on that tall buildings are to be properly located, appropriately designed and aesthetically pleasing, individually and collectively. They should create attractive landmarks enhancing Doha's character, help to provide a coherent location for economic clusters of related activities.
4. Three-dimensional urban design frameworks is as important as planning guidance in the planning process and policies formulation. Studying the potential impact of buildings on the surrounding and adjacent buildings should help the decision-making and place-making process.
5. Proposals of tall buildings should include representation of the appearance of the building and all the views affected around the base of the building, which may require a 360 degree view analysis.

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Architectural Design: Its Roles on Buildings for Sustainable Development

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Abstract

Research has shown that climate change has affected and will continue to affect humans and natural systems globally as a result of anthropogenic activities on the natural environment. These activities within the built environment cause the emission of green house gases from buildings that in turn contribute to climate change. Furthermore, over 40% of these green house emissions are from buildings and therefore, there is an urgent need to reduce these green house emissions of which can be achieved through the use of sustainable architectural building designs. This paper presents the causal relationship between buildings and climate change and draws its analysis from various literatures which highlight the role of architectural design in a changing climate for a sustainable future. This paper concludes that architectural design is an early process strategy and a key factor in achieving resilience to buildings, friendly built environment and a means to sustainable development.

Keywords

Architectural Design, Buildings, Climate Change and Sustainable Development.

Introduction

In view of the global challenges on the environment by climate change, the international agenda on sustainable development and the need for sustainable buildings spur the interest for this study. This paper examines the challenge of climate change within the built environment and highlights the international agenda on sustainability in relation to buildings. To do this, it argues for the use of sustainable design options that are environmentally friendly. Different literature is reviewed to have an in depth knowledge about the discussion and arguments that link climate change, buildings and the role of architectural design. The role of the built environment professionals and architecture is therefore critical, for the realisation of sustainable buildings. An earlier study has identified the Architect as a key player amongst other allied built environment professionals (Janda, 2010).

Furthermore, this paper presents an argument for the use of sustainable design strategies by architects as a tool that would enhance the attainment of sustainable development through the provision sustainable buildings. This position is in agreement with Halls & Rovers (2003) who argues that buildings are major players for sustainability in local and global communities. Finally, by highlighting the role of design in sustainable building development, the paper notes that designs strategies are available to the architect and suggest that research is the first step to sustainability in the built environment regarding buildings and climate change (Pyke et al, 2012). This sums up the motivation for this research review.

Method and Methodology

This paper forms parts of an early stage of a PhD research and therefore a brief concise and well outlined survey of existing related literature, reports and other documentations are reviewed to argue for this conference paper. Subsequent publications would include information from field survey. The findings from this paper are drawn from reviews which validate design as a means for the architect to produce sustainable buildings. It is also an attempt to make a wakeup call on architects to deviate from traditional design practices to sustainable design considerations.

Literature Review

Buildings and Climate Change

Buildings are man-made structures built for human habitation and other uses. Buildings form a large part of the built environment and this paper does not refer to a particular building type, they however, constitute a major aspect of human activities in the built environment. Research has also identified buildings as key players with climate change (Steemers, 2003; Lofness, 2004; IPCC, 2007). Buildings, additionally play a major role in the development of every country and forms a central part of every human daily activity (Cam, 2012), they are also significant to both the climate and the environment as acknowledged by Lam et al (2005) below.

‘Building acts as a climatic modifier, separating the indoor built environment from the external climate described by the prevailing long-term weather conditions. The climate of a particular location tends to influence the shapes and forms of the local buildings and dictates the types of environmental control required’.

Lam et al (2005), pp. 277.

Buildings account for about 30-50 percent of the world’s carbon emissions and energy consumption depending on the country (Altomonte, 2008; Omer, 2008; UNEP, 2009; Robert and Kummert, 2011). This leaves no doubts as to the relationship of buildings to the environment, and their causality to climatic changes.

Buildings may not be directly related to climate change but are seen as a major human activity that contributes hugely to greenhouse gas emission to the atmosphere resulting to global warming and of which subsequently builds up into climate change (Levine, 2008; Larsen et al, 2011; Robert and Kummert, 2011; de Wilde and Coley, 2012).

Ebohon (1996) in his position reveals that the natural environment and the built environment are closely linked and further observed that about 75% of all known factors that contribute to environmental degradation are from the built environment. Ebohon’s position further highlights the inevitability of taking sustainable actions. This position is echoed in the UN Habitat (2009) report that once again re-establish the relationship between buildings and the environment and the fact that buildings are vulnerable to the negative impacts of climate change.

Most studies show that a high potential for the reduction of carbon emission and cost-effective energy savings will rely on the design of new buildings (Roberts, 2008; Apay, 2011; Robert and Kummert, 2011). Other research has also shown that

sustainable strategies are necessary and achievable through the design of new buildings (UNEP, 2009; Akadiri et al, 2012). Furthermore, the long lifespan of buildings and the long hours of human occupation in buildings make any design decisions made today go a long way in affecting the future (UNEP, 2009; Architects 2030, 2010; Wong, et al. 2010; Gething, 2011).

Climate Change has become a global environmental problem, which has continuously affects all human livelihoods that has also become a major challenge to sustainable development. In the field of architecture the challenge is mainly on how to employ strategies in the design of buildings that address the role of buildings in relation to climate change and the environment.

The anthropogenic activities of man are mainly the causality of climate change (IPCC, 2007; Wilby, 2007; Commission for Architecture and the Built Environment CABE, 2009; Berrang-Ford et al, 2011). The link between climate and buildings is therefore significant for growth and development. The interrelationship between buildings and climate change has also been emphasised (Parry et al, 2007; Simone, 2011; Pyke et al, 2012; William et al, 2012).

It is however, the ability of these buildings not to have a negative influence on the environment that makes sustainable options desirous and important (Sanders and Phillipson, 2003; Milne, 2004, Colker, 2006). The definition of climate change by IPCC relates the changes in climate change to both natural and anthropogenic influences as the quote below suggest,

'A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use'.

IPC (2007b), pp. 557.

These forcings include variations in solar radiation, deviations in the Earth's orbit, changes in greenhouse gas concentrations as well as orogenesis (mountain-formation) and continental drifts. However, research in the built environment are particularly interested in climate change that is as a result of global warming arising from greenhouse (ghg) gas emissions increase due to antropogenic activites within the built environment (O'Brien et al, 2004; Adger et al, 2005).

However, the huge carbon emissions, especially from buildings have continually attracted concern by researchers on the continuity of the changing climate, which affects life and the built environment and the need for a critical assessment are emphasised (Keller, 2003; Trenberth, 2005; Fagre, 2007; VijiyaVenkataRaman et al, 2012). Evidently, earth's climate is changing, and the scientific consensus is that the change is increasing more rapidly than was earlier anticipated (Karl et al, 2009; NASA, 2011). This is the time to act even more seriously than before.

On the other hand, climate change has been observed to also have some direct effects on buildings and their performance, the magnitude of which are also dependants on the locations of such buildings (Camilleri et al, 2001; Adger, 2005; Crawley, 2007; Georgiadou et al, 2012).

Given the scenario on the role of buildings in the built environment and their interrelationship with climate change, professionals within the industry needed to be proactive. Furthermore, this propels the architect amongst other allied professionals in the built environment as the key player and the leadership to find architectural solutions (Janda, 2011).

This paper is particularly concern with the role of buildings which have be identified to be important to the environment and the consequently environmental sustainability. The curiosity would be to know if these buildings can be geared towards solving the increasing global environmental and developmental problems. Thus, the emergence of sustainable development.

Sustainable development

Sustainable development as a term came to limelight and made popular by the Brundtland Report (WCED, 1987), the report shaped the world approach toward development based on the three concepts of environmental growth, economic models and social well-being that are guided by choices that do not deprive the future generations. These guided principles are therefore, processes that serve as channels towards growth and sustainable development. The quotation below further clarifies how the concept three concepts are being pursued.

‘Humanity has the ability to make development sustainable – to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs. The concept of sustainable development does imply limits – not absolute limits but limitations imposed by the present state of technology and social organisation on environmental resources and by the ability of the biosphere to absorb the effects of human activities’.

WCED (1987), pp.43)

This quotation directly relates to the practice of architecture, which design and produces building for now and the future due to the longevity associated with buildings. The three pillars of sustainable development are: environmental sustainability, economic sustainability and social sustainability, they also are interdependent and all encompassing as shown in Figure 1. Thus the products of any architectural design must be duly linked with all three pillars in order that sustainable development would be ensured in the built environment.

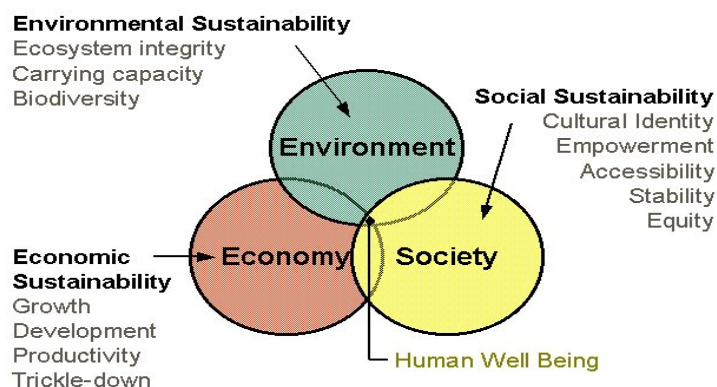


Figure1. Sustainable Development Source: <http://www.arch.hku.hk/research> (accessed 02/1/12).

In 1989 the United Nations initiated the 1992 Rio Janeiro conference to discuss the theme 'Environment and Development' leading to the 'Rio Declaration' that gave birth to the Agenda 21. Agenda 21 is the blue-print for sustainable development which had the endorsement of 179 Governments and Heads of States. By implication it aims at addressing globally; the promotion of environmental, economical and socially conscious sustainable developmental processes. In addition it requires all environmental stakeholders (architects etc) to play their roles in ensuring sustainable development to further promote the aims of the Agenda 21 (UN, 2009).

However, in the drive for sustainability there is the caution for cost implication. This caution was sounded shortly after the sustainable development came to limelight by Ozkan (1998) cited in Antoniou (1998) who expressed the notion that sustainability should not in any way add to cost but to serve as a way in which opportunities are improved upon. Thus improving the architectural practice at the design stage of buildings is by no means a venture that would necessarily add to the cost of buildings in the long run.

Sustainable development in the building sector requires considerations of climatic factors and future impacts of buildings to the environment (Colker, 2006; Hales et al, 2007; Lehman, 2010). Additionally, sustainable buildings are expected to have low or minimal negative impacts on the natural and built environments, the ecosystems, and to add quality values to human, aesthetics, economic social capitals and diversities (Hadjri and Onyango, 2007; Burton, 2009; Wang et al, 2010).

Sustainable architecture and design

The interrelationship between buildings, the environment and climate has been highlighted, so also the need for a sustainable building through sustainable design in the earlier paragraphs of this paper. The continues demand for new buildings and infrastructures (Joseph and Abraham, 2010) present an overwhelming challenge to the architect's design approach, processes and choices; to reflect sustainable options, user comfort, cost and aesthetical value (Hui, 2004; Bunz et al, 2006; UNEP, 2009; Lehman, 2010).

Achieving sustainable living at an early stage in buildings is an attainable goal through architectural design processes that are holistic. An earlier study by Straube (2006) suggested that making buildings sustainable is practicable and achievable and a vital key for sustainable development. He also added that the key factors for a sustainable environment includes; awareness of the problems involved, design skills and specifications, construction and building operations. It is arguable to single out design because it is an initial intervention, getting it wrong means other factors would sway.

Architectural design deals with the science and art of bringing together elements to create a functional building or structure in line with a chosen approach in order to achieve the proposed brief within available limits. It is the choices to be made and the approaches to be explored by the architect as a building designer that forms the primary focus of this paper. These choices and strategies have significant implications; for the buildings in themselves and the built environment.

The architectural practice (especially design) reflects on the interrelationship between buildings and climate which in turn affects the environment in which the building is located (Lam et al, 2005). Basically, a sustainable design is a futuristic design that is

conscious of environmental considerations for today and the future. Sustainable design is often use interchangeable with sustainable architecture. Sustainable architecture also referred to as ‘green architecture’ which is defined as;

‘Green architecture, or green design, is an approach to building that minimizes harmful effects on human health and the environment. The "green" architect or designer attempts to safeguard air, water, and earth by choosing eco-friendly building materials and construction practices’.

Craven (2013), pp. 1.

Given the above definition, it is also easier to refer to sustainable or green design as deliberate conscious design that is environmental friendly. According to Craven (2013) the goal of a green design is to be sustainable in its decisions, choices and applications and went further to items the characteristics of a green architecture to include the following:

- Ventilation systems designed for efficient heating and cooling
- Energy-efficient lighting and appliances
- Water-saving plumbing fixtures
- Landscapes planned to maximize passive solar energy
- Minimal harm to the natural habitat
- Alternate power sources such as solar power or wind power
- Non-synthetic, non-toxic materials
- Locally-obtained woods and stone
- Responsibly-harvested woods
- Adaptive reuse of older buildings
- Use of recycled architectural salvage
- Efficient use of space

These characteristics suggest that due the challenges of a changing climate the role of design is no longer business as usual. The International Panel on Climate Change IPCC (2007) expressed concerned and suggests that buildings must be made to reduce drastically their energy consumption and be made to adapt to the impacts of climate change. This poses a challenge to the architecture professional (Marsh et al, 2010), who is faced with a critical challenge of producing designs that addresses energy performance of buildings in order to reduce carbon emissions from the increasing energy demand in buildings without a compromise to comfort, cost, flexibility of the building to adapt to changing climate, durability, aesthetics and increase the life span of the building (Petersen and Svendsen, 2010; Grierson, 2011). Making the architect to become more conscious during the design processes in creating buildings that would satisfy the overall goal of sustainability in providing a sustainable building that would lead to sustainable development in the long-run.

However, Gul and Mendes (2012) conducted a study titled, ‘Designing Domestic Buildings for Future Summers: Attitudes and Opinions of Building Professionals’. Even though this study is targeted at domestic buildings it has bearings on the built environment and design, some of their result covers to a large extend all buildings. Their study employed the use of questionnaires, focus groups and semi-structured interviews on the built industry professionals and alarmingly their findings showed that traditional design practices; which adhere strictly to client’s requirements, meeting minimum standards and regulations and cutting capital cost were still being

maintained. Implying that the traditional design practices are being maintained, which excludes climatic and futuristic sustainable consideration even in the UK.

In their conclusion Gul and Mendes (2012) observed amongst many the quote below:

‘Delivering buildings that provide the optimal balance between a high quality indoor environment and reduced carbon dioxide emissions is a challenge that is becoming increasingly important. The decisions we make today will determine how well buildings can deliver on those objectives over their design lifetimes’.

Gul and Mendes (2012), pp. 759.

This quote sums up the important role design plays in the life of a building. Other concluding remarks that have direct relevance to this paper are; to encourage design professionals in the building industry to use related available tools (like the UK climate projections UK09 and the Low Carbon Futures LCF) as a soft landing framework, choices by designers to include future energy and performance, designers to adopts favourable active and passive design strategies and to incorporate sustainable building practices in line with government initiatives for sustainable development.

Design criteria for environmental sustainability

A recent study carried out by Conejos et al (2013) supports the use adaptive reuse tools in the design of new buildings in order to reduce carbon emissions and promote the built environment sustainability. Their study was carried out using a mixed method methodology through the use of literature review, case study analysis, expert interview and practitioner survey to collect data, triangulate and validate their findings.

Furthermore, Conejos et al (2013) assert the importance of knowing how new buildings are designed for future buildings adaptability and sustainability. They also generated some design criterions that were based on their current and previous study (see Conejos, 2011; Conejos, Langston and Smith 2011). The sustainable design concept/ guidelines formulated in terms of their category and criterion that includes the Tables 1a-1d (the table is split into three to conform to the conference regulation to have a table within the same page).

Table 1a: List of design criteria based on experts’ (for Physical, Economic and Functional). Source: Conejos et al (2013), pp. 99. (adopted version).

Category	Criterion
Long Life (Physical)	<ul style="list-style-type: none"> -Structural Integrity-structural design of the building to cater future uses and loads - Material Durability-durability of the building asset -Workmanship-quality of craftsmanship of structure and finishes -Maintainability-building’s capability to conserve operational resources - Design Complexity-various geometries associated with the building’s design and

	innovation -Foundation-differential settlement and substrata movement
Location (Economic)	-Population Density-location within major city, CBD, etc - Market Proximity-distance to major city, CBD, etc - Transport Infrastructure-availability and access Site Access-proximity or link to access roads, parking and communal facilities - Exposure-views, privacy Planning Constraints-site selection, planning, neighbourhood and building design, etc. - Plot Size-built area, spatial proportions, enclosure, etc.
Loose Fit (Functional)	-Flexibility-space capability to change according to newly required needs, plug and play elements, etc. -Disassembly-options for reuse, recycle, demountable systems, modularity, etc. -Spatial flow-mobility, open plan, fluid and continuous -Convertibility-divisibility, elasticity, multi functionality Atria-open areas, interior gardens, etc Structural Grid-ideal and economical limit of span and fully interchangeable -Service Ducts and Corridors-vertical circulation, service elements, raised floors, etc.

Table 1b gives a self explanatory of three categories; physical, economic and functional considerations and the sustainable design criteria for each and same application follows for Tables 1b and Table 1c respectively.

Table 1b: List of design criteria based on experts' (Technological, Social and Legal)
 Source: Conejos et al (2013), pp. 100. (adopted version).

Category	Criterion
Low Energy (Technological)	-Orientation-micro climate sitting, prevailing winds, sunlight, Glazing-sunlight glare control and regulate internal temperatures, -Insulation and Shading-thermal mass, sunshades, automated blinds, etc. -Natural Lighting-inclusion for natural daylight, efficient lighting systems, etc. -Natural Ventilation-optimize airflow, quality fresh air, increased ambient air intake, etc. -Building Management Systems-monitor and control building operations and performance systems -Solar Access-measures for summer and winter sun
Sense of Place (Social)	-Image/Identity-social and cultural attributes, values, etc. -Aesthetics-architectural beauty, good appearance, proportion, etc -Landscape/Townscape-visual coherence and organization of the built environment -History/Authenticity-original fabric, timelessness, socio-cultural traditions, practices, historic character or fabric, etc.

	<ul style="list-style-type: none"> - Amenity-provides comfort and convenience facilities -Human Scale-anthropometrics and fit to average human scale Neighbourhood-local and social communities
Quality Standard (Legal)	<ul style="list-style-type: none"> • Standard of Finish-provision for high standard workmanship • Fire Protection-provisions for fire safety • Indoor Environmental Quality-provisions for non-hazardous materials, natural fabrics, etc. • Occupational Health and Safety-special needs of occupants, health and safety risks, building hazard and risk management plan • Security-provision of direct and passive surveillance designs Comfort-hygiene and clean environment, etc • Disability Access-provision for disability easement, facilities, etc. • Energy Rating-environmental performance measures • Acoustics-noise control, sound insulation, etc.

Table 1c List of design criteria based on experts' (Political) Source: Conejos et al (2013), pp. 100 (adopted version).

Category	Criterion
Context (Political)	<ul style="list-style-type: none"> • Acoustics-noise control, sound insulation, etc. Context (Political) Adjacent Buildings-adjacent enclosures, vertical and visual obstacles • Ecological Footprint-appropriate measure of human carrying capacity • Conservation-principles, guidelines, charters governing tangible and intangible heritage protection • Community Interest/participation-Stakeholder relationship and support • Urban Master plan-integrated skyline, urban landscape, built environment design and management/practice • Zoning-land uses and land patterns • Ownership-collaborative commitment, sense of community or ownership, etc.

Conclusions and further research

Literature were reviewed to investigate the relationship between climate change, buildings and sustainable development in the built environment and what roles architectural design play in the life of a building. As indicated by the study, there exist interrelationship between buildings, the built environment and climate change.

Buildings serve as interface between the indoor and the outdoor environments as well as a major contributor to carbon emission that causes climate change and of which in turn affects and have negative impact on buildings. Thus, both have complimenting roles but the potentials for the positive roles are to be pursued.

Studies have also shown that a high potential of reducing carbon emissions and enhancing climate sensitive buildings lies in the design of sustainable buildings, through incorporating sustainable conscious choices: passive design that allows for natural capacity and recognises sustainable concept of economics, environmental and social practices within communities. The role of architectural design is therefore, crucial and relevant in the improvement of the buildings themselves and their roles on the environment in ensuring a friendly environment that promotes and pursue sustainable developmental goals.

Sustainable design is the architectural design approach that architects explore to create sustainable buildings in meeting with the continuous need and demand for buildings and at the same time pursuing the global agenda of sustainable development. Architects must therefore, make sustainable design decisions for sustainable buildings that would not only reduce emission, provide comfort and friendly environment but to also promote sustainable development. Sustainable buildings are therefore necessary, vital, and important for local and global communities. This paper also serves as a wakeup call to architects to integrate these options in their building designs

The scope of this paper is limited to the early stages of a PhD research and basically a general approaches to findings are employed. Further study will engage empirical study to give specific data for specific communities in the quest for sustainable development that have become synonymous with local and global communal growth that do not compromise the future.

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Exploring success factors for private sector participation in urban regeneration project delivery: A methodological framework

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Abstract

Urban regeneration policy and practice is at a major crossroad in the UK following recent changes in the policy and funding context. This presents major implications for local authorities in planning and delivering urban regeneration projects with private sector actors. This paper presents a methodological framework, developed from the relevant literature and practice, to provide an understanding about the success factors for private sector participation in the delivery of urban regeneration projects in order to develop conceptual knowledge and draw lessons for urban regeneration practice. The questions generated by this methodological framework are informing an ongoing professional doctorate case study research being carried out at the School of the Built Environment, University of Salford.

Keywords

Urban Regeneration, Success Factors, Private Sector, Methodological Framework.

1. Introduction

In view of many experts (e.g. Parkinson, 2009), the financial model that supported regeneration efforts in the past decade is fractured and lacking relevance in prevailing economic climate. Several authors have now documented the implications of the financial crisis post 2008 and the assumption of office of the new Conservative-Liberal coalition in 2010 on the future of urban regeneration policy and practice in the UK (Lowndes and Pratchett, 2011; Shaw and Robinson, 2010). Tyler et al (2012) estimated the average annual core regeneration expenditure of £10,144 million in England for the years 2009/10 and 2010/11. With the cessation of most of the funding streams and programmes previously operating, local authorities' role in delivery has needed to change to a more entrepreneurial outlook (Granger, 2010), to encourage greater private sector participation in the delivery of projects with a greater focus on economic growth and jobs within the new architecture for urban regeneration practice.

The first section of the paper starts by reviewing and defining key concepts in this area and presenting a statement of the research problem. The following section reviews the literature on private sector participation in urban regeneration projects. A review of the main contributions to the study of the success factors and management of private sector participation is presented in sections 3 and 4 respectively. Section 5 describes the empirical methodological framework followed by a discussion of case study selection in section 6. The final section outlines the main conclusions and the expected contributions of the research.

1.1 Defining Key Concepts

Urban Regeneration - The dictionary definition of 'regenerate', is "to undergo or cause to undergo moral, spiritual, or physical renewal or invigoration", "to form or be formed again; come or bring into existence once again", "to replace (lost or damaged tissues or organs) by new growth, or to cause (such tissues) to be replaced" and "to restore or be restored to an original physical or chemical state." (Collins, 2009). 'Urban regeneration' is therefore concerned with changing the characteristics of an urban area from an existing condition to restore what was before or to create a new situation.

Successive pieces of UK legislation have attempted a definition of urban regeneration from "resolving the social and economic problems of an area" (Inner Urban Areas Act 1978), to "by bringing land and buildings into effective use, encouraging the development of existing and new industry and commerce, creating an attractive environment and ensuring that housing and social facilities are available to encourage people to live and work in the area" (Local Government, Planning and Land Act 1980), and "activities contributing to the regeneration of an urban area include in particular: (a) securing that land and buildings are brought into effective use; (b) developing, or encouraging the development of, existing and new industry and commerce; (c) creating an attractive and safe environment; (d) providing housing or social and recreational facilities so as to encourage people to live and work in the area; (e) providing employment for people who live in the area; (f) providing training, educational or health facilities for people who live in the area" (Leasehold Reform, Housing and Urban Development Act 1993).

Roberts and Sykes (2000) provide a definition of urban regeneration as: "...comprehensive and integrated vision and action which leads to the resolution of urban problems and which seeks to bring about a lasting improvement in the economic, physical, social and environmental condition of an area that has been subject to change".

Couch (1990) however makes a distinction between urban regeneration and urban renewal which he described as "a process of essentially physical change". The UK Government regeneration framework document 'Transforming places, changing lives' (CLG, 2009) defines regeneration as 'Reversing economic, social and physical decline in areas where market forces will not do it without support from the government'. This provides a useful definition for the purpose of this paper.

It is clear from these definitions that urban regeneration could be perceived as holistic and all-encompassing with economic, physical, social and environmental dimensions. A narrower definition which primarily concerns the delivery of major physical projects is adopted for the purpose of this research. While urban regeneration projects might seek to bring about wider economic, social and environmental benefits, the complexities of undertaking research that establishes wider relationships within the economic, social and environmental dimensions means that a wider remit to the definition will be beyond the scope of the proposed research.

Project Success - Success means different things to different people and is very context-dependent (Freeman and Beale, 1992). Project success is at the heart of project management and is therefore among the top priorities for project managers and project stakeholders. The definition of project success has evolved in project management literature over the past 40 years from one that merely measured the

‘golden triangle’ of time, cost and quality (Cooke-Davis, 2002) to one that recognises its stakeholder-dependent nature (Muller and Jugdev 2012).

Cooke-Davies (2002) makes two important distinctions when attempting to define success in the context of projects. The first is to distinguish between project success (measured against the overall objectives of the project) and project management success (measured against the widespread and traditional measures of performance against cost, time and quality). The second distinction is the difference between success criteria (the measures by which success or failure of a project or business will be judged) and success factors (those inputs to the management system that lead directly or indirectly to the success of the project or business).

Critical Success Factors - The concept of critical success factors was first introduced in the 1960s (Daniel, 1961) and later popularised in the 1970s (Rockart, 1979) as a management tool for organisations. Rockart (1982) defines CSF as “those few key areas of activity in which favourable results are absolutely necessary for a manager to reach his/her goals”. Since then, many definitions of critical success factors have been offered but one of the most accepted definitions is "those few things that must go well to ensure success" (Boynton and Zmud, 1984).

Statement of the Problem

Urban regeneration is at a major crossroad both in terms of policy and practice and the need to identify a framework of success factors for the delivery of urban regeneration projects within this new context is an important one for practice. A number of researchers have highlighted the need to develop new models for regeneration delivery post recession (Carpenter, 2011; Squires and Moate, 2012).

During the initial literature survey, no direct literature has been identified on the success factors for private sector participation in the delivery of urban regeneration projects that is specifically related to Greater Manchester, England or the wider UK context.

The proposed research seeks to explore the success factors for private sector participation in the delivery of urban regeneration projects in order to understand and explain "those few things that must go well to ensure success" (Boynton and Zmud, 1984).

In addition to creating awareness, the proposed research will seek to provide information in the following areas:

- Critical review of relevant literature on success factors for private sector participation in the delivery of urban regeneration projects
- Major contemporary issues in urban regeneration project delivery
- Identification of the success factors for private sector participation in delivery of urban regeneration projects

The aim is to provide local authorities, practitioners and key stakeholders in urban regeneration project delivery with the information for effective selection, planning and delivery of projects.

2. Private Sector Participation in Urban Regeneration

Private sector participation in urban regeneration in the UK has mainly been studied through the lens of public-private partnerships (PPP) in the involvement of business

elites in local authority governance (Cook, 2009). Koppenjan and Enserik (2009) postulate four necessary conditions for private sector investment in projects: creating prospects of return on investment; managing the scope of project and externalities; managing risks perceived by private parties and reducing political uncertainties.

Adair et al (1999) identified that there was no fundamental difference in private investment decision criteria in urban regeneration compared to other property investment opportunities. The maximisation of return from the invested capital is the prime goal and whenever uncertainty increases beyond a certain threshold other investment alternatives will appear more attractive. Risk and uncertainty is one of four equally important factors: capital appreciation (investor demand), rental growth (occupier demand), perceived level of risk and finally the quality of the development (Jensen, Larsen & Storgaard, 2011).

A typology of the different private sector actors involved with investing in urban regeneration projects is presented in the table below.

Table 1: Typology of investors and developers in urban regeneration (adapted from Jensen, Larsen and Storgaard, 2011)

Private project developers	Typical investors
Homeowners	Equity, banks and other financial institutions
Private rental housing	Equity, residents (rent), Property-owners Investment Fund (loan), banks and other financial institutions (loans and equity)
Shops, services, industries	Equity, banking and credit (loans and credit)
Housing associations	Loans (banks), grant (Homes and Communities Agency), equity
Professional developers	Equity, smaller investment funds, banks and other financial institutions, institutional investors, future owners and renters (housing, shops, business, etc.)

3. Success Factors for Private Sector Participation

Before examining success factors, it is important to identify those factors that actors consider important in making decisions and acting. These decision factors are perceived by the actors to be outside of the agents' immediate control but affect the decisions that they make.

Previous research extensively utilise quantitative factor analysis in identifying decision factors and success factors. However, this research will focus on qualitative methods to develop a richer understanding of the factors that actors perceive to be important to their decision making and successful outcomes in project delivery.

Rhodes (2005), in a study of the Irish housing system, identified that organisational actors consider three different kinds of decision factors: factors outside the control of the actor and the system in which they participate; factors that are primarily a result of the system itself, but outside the control of any particular actor; and factors generally

considered to be within the control of the actor, but that cannot be changed rapidly. These three kinds of decision factors are categorized as “external,” “emergent,” and “internal” based on the degree to which they are affected by actor behaviour.

No literature has been identified that examines success factors for private sector participation in urban regeneration project delivery specifically. However there is a body of literature on success factors for construction generally (Tang, Shen & Cheng, 2010) and other areas of the built environment disciplines.

Yu and Kwon (2011) developed a framework for identifying the potential critical success factors for urban regeneration projects shown in Fig. 1 below.

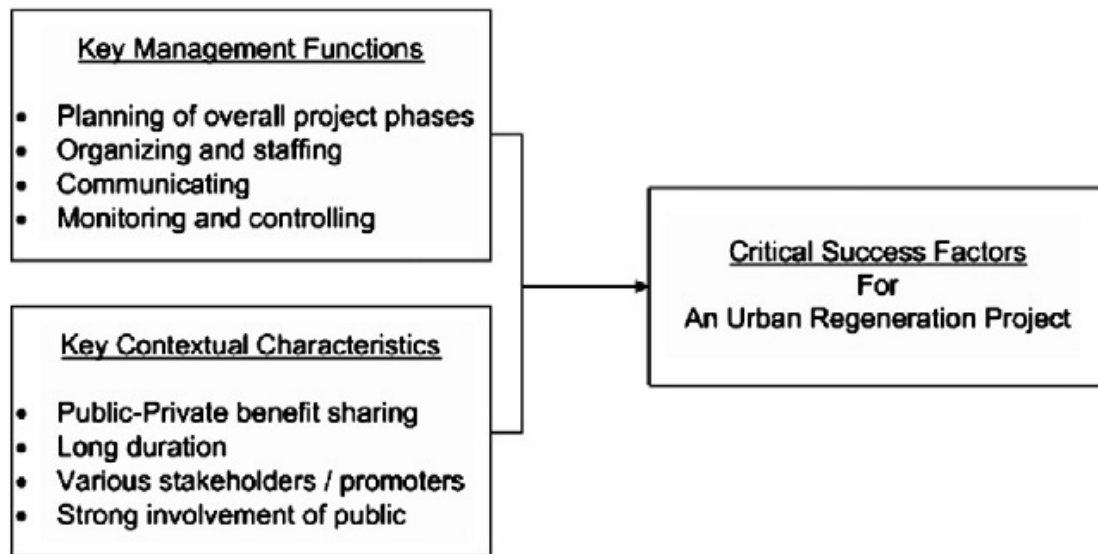


Fig. 1. Process and Key Players for an Urban Regeneration Project

Yu & Kwon (2011) adopted this framework using brainstorming and a Delphi survey to identify 10 critical success factors for urban regeneration projects as: (1) Minimization of conflict between stakeholders; (2) Optimization of legal and administrative services; (3) Standardization of decision making process; (4) Good communication and information sharing; (5) Reasonability of project master and implementation plans; (6) Suitability of project management system; (7) Establishment of appropriate organizational structure; (8) Cooperativeness of stakeholders on project; (9) Performance management at each phase; and, (10) Balanced adjustment between the public and the private interests.

4. Management of Private Sector Participation

The challenge for local authorities in the UK, in a climate of dwindling public resources, is to maximise private sector participation and investment in the delivery of urban regeneration projects. Over the past decade, much of the discourse has focused on organisational forms of public private partnerships. However, there is now a body of literature that emphasise the importance of the management of such relationships in achieving desired outcomes (Koppenjan & Klijn, 2010).

Two management theories are particularly useful in seeking an understanding of the theoretical constructs for local authorities seeking to manage private sector participation – New Public Management and Governance.

New Public Management (NPM) postulates that governments should focus on formulating policy with implementation carried out by private and non-governmental entities (Osborne & Gaebler, 1992). In NPM, the public sector's role is to exercise control through performance measures and market mechanisms (Hood, 1991).

Governance, on the other hand emphasises the importance of management and can be viewed as "the capacity to organise collective actions towards specific goals" (Hillier, 2002). The assumption is that coproduction between public and private actors result in better exchange of information which fuels the creation of more innovative products (Kort & Klijn, 2011). Governance literature postulates that successful outcomes cannot be achieved without concerted network management with public and private actors collaborating in horizontal, non-hierarchical structures (Agranoff & McGuire, 2003).

Kort and Klijn (2011) conclude that network management strategies have a significant impact on successful outcomes for urban regeneration while organisational forms do not. This is an important conclusion, albeit from one study, and provides a useful basis for developing the theoretical construct for this research.

5. Methodological Framework

A methodological framework is helpful in illustrating the methodological scope of this research. The framework presented in Table 2 below shows the linkages between the theoretical constructs, concept, methods and techniques and identifies the aims and research questions to be addressed.

Table 2 indicates a hierarchical methodological scope that links the predominant theoretical constructs and concepts with the tangible methods and techniques and the individual research aims and questions to be addressed. The theoretical constructs identify the useful theories available in literature for the comprehensive study and understanding of the cases. This is followed by the development of an empirical analytical model which provides the analytical frame to bring forth insight on the phenomena. The methods focus on case selection, comparative analysis and reflexivity which are supported by techniques of document review, interviews/surveys and content analysis.

6. Case Study Selection

Yin (2003) identified the several types of case study research as exploratory, explanatory, and descriptive case studies. Exploratory case studies are often conducted to define research questions and hypotheses. Explanatory case studies seek to link an event with its effects and are useful for investigating causality. Descriptive case studies are often used to illustrate events and their specific context.

Single or multiple cases can either be investigated in a longitudinal setting to understand changes over time or in a comparative setting to identify differences between cases. The choice of single or multiple cases depends on the objectives of the study, research questions and available resources but Proverbs and Gameson (2008) advocate that great care is taken before selecting a single case as the results of a multiple case study will invariably be more 'compelling'.

The initial proposal is to undertake a multiple case study for this research composed of a pilot case study and three case studies. The pilot case study will be used to refine

the research questions, methodology and data collection plans as well as obtain data as recommended by Yin (2003). The case studies will be selected based on a number of criteria. Firstly, they will need to be perceived by stakeholders as urban regeneration projects and not merely urban development projects. Secondly, they are seen as to have been or being successfully delivered from the researcher's knowledge in practice. Conducting multiple case studies in this manner will enable cross-case or comparative analysis and makes it possible to build a logical chain of evidence (Yin, 2003; Miles and Huberman, 1994).

Table 2: Methodological Framework

Theoretical Constructs	<i>Network Management, Governance, New Public Management, etc</i>		
Aim	Comprehensive project-based understanding of the success factors for private sector participation in urban regeneration project delivery		
Question	1. Which theoretical constructs are most suitable to study private sector participation in the delivery of complex urban regeneration projects?		
Concept	<i>Analytical Model</i>		
Aim	Detailed analysis of research variables		
Question	2. What model(s) can be used to understand the success factors for local authority and private sector actors?		
Methods	<i>Case Studies</i>	<i>Comparative Analysis</i>	<i>Reflexivity</i>
Aim	Data collection	Data analysis and comparison	Drawing lessons upon reflection
Questions	3. How do local authority and private sector actors manage the delivery of urban regeneration projects in Greater Manchester?	4. What are the success factors for private sector participation in urban regeneration project delivery?	5. What lessons for practice can be drawn from these projects for local authority and private sector actors?
Techniques	<i>Document Review</i>	<i>Interviews/Surveys</i>	<i>Content Analysis</i>
Aim	Obtain documentary information	Obtain knowledge and perception of project experience	Undertake comparative analysis
Questions	6. What information	7. What are the	8. How can we

from academic/practice literature and case documents provide useful insight?	empirical experiences perceived by the different involved?	project as the actors	compare data from the different cases?
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7. Conclusion

This paper has presented a methodological framework for exploring success factors for the delivery of urban regeneration projects. Case study is selected as the primary research method with reflexivity to further enrich the practitioner nature of the research.

The expected contribution of the research to knowledge and practice is through providing an understanding of the success factors for private sector participation in the delivery of urban regeneration projects and thereby developing conceptual knowledge and drawing lessons for professional practice.

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Master Planning System: Constraints for planning Authorities in Jos Metropolis, Nigeria

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Abstract

The Impact of development plans is positively felt only when there is an implementation of a good people-oriented design and government willingness to be part of the effort. This paper seeks to critically assess the master planning system and its constraints on planning authorities in Jos, metropolis Nigeria, by identifying and examining the characteristics as well as the effectiveness of master planning system in Jos metropolis. The Nine planning authorities in Jos metropolis were purposively sampled and used for the study. Secondary data based on the characteristics and effectiveness of the master planning system were utilised for the study. The results shows that the master planning system is an out-dated means of planning owing to its characteristics, which inter alia makes it not relevant to current trends and not as effective for the Jos metropolis to allow the needed growth and development. Recommendations are offered that would guide future urban development in conformity to the growth rate within the region.

Keywords

Master Planning system; Planning Authorities, Constraints and Effectiveness

1. Introduction

The Commonwealth Association of Planners in Africa is poised to contribute towards providing solutions to Africa's problems (CAP, 2009). Nyambo (2010) observed that the inability to bring about sustainable development has always been affected by the lack of sustainable urbanisation and an appropriate planning approach which is not appropriately implemented. The major problems have always been rapid urbanisation, growth of slums and urbanisation of poverty as well as poor conservation of natural environment. Nigeria (Abuja) has the highest level of urbanisation in Africa, hence due to proximity of Jos metropolis to Abuja makes it get the spill over effect, which has a direct bearing with the socio-economic and demographic as well as the cultural characteristics. The current institutional framework of urban and regional planning system (Master planning) in Nigeria and Jos, Metropolis to be specific cannot adequately address the urban problem of urbanisation and its physical characteristics (Oyesiku, 2004; Agbola, 2004; Alabi, 2008). This is necessitated by the social, economic, environmental and political constraints in the urban planning procedures in the metropolis. Hence, an effective urban planning system is required to address the urban sprawling and its characteristics in the metropolis. Good governance brings about good planning and helps in achieving the millennium Development Goals, through the effective implementation of the urban and regional plans, particularly

where land is adequately supplied for development, accommodating investment and working with less privilege to improve the standard of living for the people.

The physical planning strategies are geared towards an effective planning and management of most urban and regional areas would help in bridging the dichotomy that exists between the rural and urban by increasing accessibility between rural areas to urban areas and to the opportunities that exist. A strong planning system, based on up to date plans, emerging from current information is needed to address the situation in most African countries because of its dynamic nature. Hence, sprawling conditions characterised by fast slums occurring making the problem grow rather than diminish (Amanda, 2009). A plan that identifies and brings forth adequate quantities of land for development into the safe and accessible location is most appreciated. The era of and the legacy of failed master plans that are rigid and fixed have left cities, urban areas, residents and the surrounding environment poorly equipped to cope with the exploding urbanisation levels (Jiriko, 2007). These cities are important to African and Nigeria in particular, having poor growth and haphazard development, but due to poor provision of the needed infrastructure such as sophisticated management and effective leadership, it has been robbed of standard and effective plan-led modernisation and growth (CAP, 2005; Litman, 2011). Good governance makes a difference in good planning because its key to the design and implementation of a good planning approach as the market forces usually are not to be relied on, however, the solution is always in effective public sector action as the government plays a vital role in stabilising the economy at all levels (Cohen, 1988). It is against this back drop that an alternative planning is agitated to be applied as a strategic planning tool to the Jos metropolis to address the physical planning problem by identifying and examining the characteristics as well as the effectiveness of master planning system in Jos metropolis.

2. Literature Review

2.2 Master planning system

Okeke (2002) consider master planning as a process of doing orderly and managed sequences of actions to achieve the targeted goal. It is any pursuit that is intended to cater for the present requirement which might not be adapted for the future, such activity will have to be carried out in such a way that it respond to future occurrences. In other word it is defined as foresight in formulating and implementing programmes and policies generally focused on resource allocation over a time period. Successful planning is generally guided by past experience to solve the problem (Webber, 1968; McLounghlin, 1979).

Different systems of planning exists and, are applied at different places for different reasons addressing different kinds and types of problems, with different dimensions and coverage , for instance district plans , development plans , strategic plans, master plans , spatial plans , action plans and subject plans amongst other plans. For the purpose of this section emphasis would be on the master plan. It is a comprehensive long range plan intended to guide growth and development of a community or region. Emphasizing its included analysis, recommendations, and proposals about the community's population, economy, housing and basic infrastructure as well as land use. It is based on public input, surveys, planning initiatives, existing development, physical characteristics, and social and economic conditions (Mabogunji, 2001).

According to Suleiman, 1986 the advantage of the master plan lies in its physical components, land use; circulation, housing, provision of facilities, utilities and services; open spaces and urban design. Further advantage of the plan is that History has that 1920 and 1960 were eras of 'Blueprint' comprehensive master plans were the rule (Agwu, 1998; Jiriko, 2007). The comprehensive master plans were prepared for cities such as London, Rome and Washington D.C amongst others. These conventional concepts, ideas and approach were imported to Nigeria and some other developing countries with colonisation and used as a spatial planning strategy (Agwu, 1998; Jiriko, 2008).

Nigeria has a high rapid rate of urbanisation which has made the urban master plans inapplicable since they were not originally meant for application in dynamic environments. Planning is an evolving process concerned with constantly changing societal and environmental problems as observed by Mabogunji (2002) Jiriko (2008).

Professional town planners in Nigeria have being dogmatic about master planning system on which the success of the urban planning practice virtually hinges as they belief (Falade, 2002; Jiriko, 2008). Agwu (1998) considered the pros and cons of urban master planning and judged from the past experience and concludes that it is wishful thinking to encourage a planning authority in Nigeria to go into master planning. Furthermore, the changing socio-economic conditions in the country has encouraged the review of the University master plans as the national university commission has recommended strategic planning as an alternative planning approach to restructure the University system to match the prevailing circumstances (Mba, 1992; Local government Association, 2001; Falade, 2002; Jiriko, 2007).

Based on the observations raised master plan has its weakness, yet has been a working tool for the planners at different levels in Nigeria and this has brought about development in the whole, as it is the planning system employed in the country to ensure that some form of planning is incorporated in to the system to bring about growth and development. The main aim of the next section is to examine the application of master planning to the metropolitan /urban cities in Nigeria with a view to assess the effectiveness of the system of planning over time.

United Nation policy advised on how master planning could be used to address the problems of housing, urban development and planning in different cities in the developed and developing countries such as USA, Australia, Singapore, Malaysia and Nigeria. The situation in Nigeria revealed that cities of developing countries (Asia and Africa inclusive) were growing and changing very fast than the European cities did during the industrial revolution. However planning methods or systems are insufficient to guide the development in such countries and master planning has actually imparted very little on their growth (Awogbemi, 1997; Mabogunji, 2002; Jiriko, 2008). Jiriko (2008) also observed that town planners have become very unpopular and stressed out as the master plans have failed and they were unable to identify the immediate causes. Koenigsberger (1982) observed that the planning approach was inappropriate for the tropical countries and that it was like that because it was unsuitable as it was developed for a different type of society, and a high demand for other alternatives (Egbu, 2007).

Devas (1993) point out that during and after the colonial era many ideas and concepts applied development in developing countries Nigeria inclusive were derived from the practice of town planning in Britain. Oyesiku (2004) argued that this physical

planning approach has found increasing disfavour in developed countries but was exported into many less developed countries during the 1950s and early 1960s where it is being used till date. Developing countries such as India, Madras, Karachi and Dhaka amongst others have adopted master planning systems for several cities but yet are almost useless. They usually involve wildly accurate population projection, and land use zoning that deviate dramatically from reality. It also has inflexible conditions that are not adjustable as the conditions change.

Furthermore, master planning approach has been observed to be of almost a static nature, attuned to a scenario of slow urban growth in which investments in infrastructure such as roads, services and other public investment could be carefully planned in the context of a finite long term plan. Rapid population growth, lack of infrastructure and service, shortage of funds and staff in the typical developing country city require a more dynamic planning process in which priorities have to be continually assessed and reassessed in the light of the available resources (Jiriko, 2007; Litman, 2009).

Farvacque & Mc Auslan (1992) argued that master plans take unnecessarily long time to prepared and seldom offer guidance on the phasing and techniques of implementation; they seldom evaluate cost of development the propose or try to determined how they could be financed. And also pay little or no attention to the necessary resources allocation and financial feasibility of policies and programmes. Both criticism shows that master plans are seldom based on realistic appraisals of the city economic potential or likely population growth; that communities, community leaders and implementation agencies are seldom meaningfully involved in the master planning process. And that they are constantly been updated and their static nature cannot keep with the dynamic process of the city growth in the developing countries.

Master planning has been a wishful rather than productive enterprise, as it is an imaginary constructs, which represent physical objects and both their external and internal relationships in space: the emphasis is restricted to analysis of the spatial structure, urban form and land use patterns (Rose, 1974).

Physical planning approach have tended to pay scant regard to the ecological , social , economic and political processes, which together make up the environment of man, be it urban , regional, national or supra national (Jiriko, 2008; Chaolin, Xiaohui, & Jing, 2010).

2.3 Planning Authorities in Jos, Metropolis Nigeria

These are planning bodies which could be public or private or a council that is empowered by law to exercise statutory town planning functions for a particular area or jurisdiction (Oyesiku, 2004; Ekop, 2007; Ekop & Uyanga, 2007). It could be used with different prefix, depending on the nomenclature it is given. These Local planning authorities also exist in other parts of the world (Ratcliffe, Stubbs & Shepherd, 2002; Oyesiku, 2004 pg. 491).

Saddled with the responsibility of granting planning permissions which are usually granted subject to a planning condition which requires that the development commencing within a specific time frame stipulated by the region or jurisdiction granting such permission such as (2-5 years) (Oyesiku, 2004). For instance, the building standards codes has to be followed to approved drawings, trees to be planted, the colour, finishing and even the external materials amongst others, before the

approval by the local planning authority. This will serve as planning permission before any development starts on the site given the conditions for granted permission which is related to implementation. Section 55(1) of the 1990 TCPA define development as ‘the carrying out of building, engineering, mining or other operations in, on, over or under land or the making of any material change in the use of any buildings or other land’. This definition has always provided the basis for the development control system (Ratcliffe, Stubbs & Shepherd, 2002; Obateru, 2004pg. 131).

In order to control developments outside the defined application site (such as related highway improvements, high tension wire (electricity)) then the implementation of those aspects can required special conditions or most for the approval. Development takes place without permission as the process involved in obtaining this permission is cumbersome, rigorous and unending making it difficult and most at time utopia for the developer to obtain the permission (De Soto, 2000; Ekop, 2007). This singular act has made it very difficult to control development by the numerous planning authorities which is a good reflection of what obtains in most developing countries and on the long run tend to consider such developments which would come up haphazardly, illegal or informal settlement (De Soto, 2000; Parsa *et al*, 2010; Wapwera, Ali & Egbu, 2011). The planning authorities are best characterised by their functions, roles and responsibilities taken to modify the areas within their jurisdiction.

The Town and Country Planning Law (TCPL) was modelled from the United Kingdom Town and country planning Act, 1932. It was to bring about improvement and control development by means of planning schemes to be prepared by the authorities appointed by the governor as stated in section 4. This section intends to demonstrate through a careful consideration of the models obtained in Nigeria to give a wider understanding of how the planning authorities operate at various levels and their nature (Hull,1995; Healey, 1997; 2004; 2007; Pinto, 2000; Jos Metropolitan Development Board JMDB , 2006; Nallathiga, 2008; Rydin, 2011). Figure (1) gives a picture of the way these planning authorities and agencies have common capacity measuring in a framework adopted from the global literature.

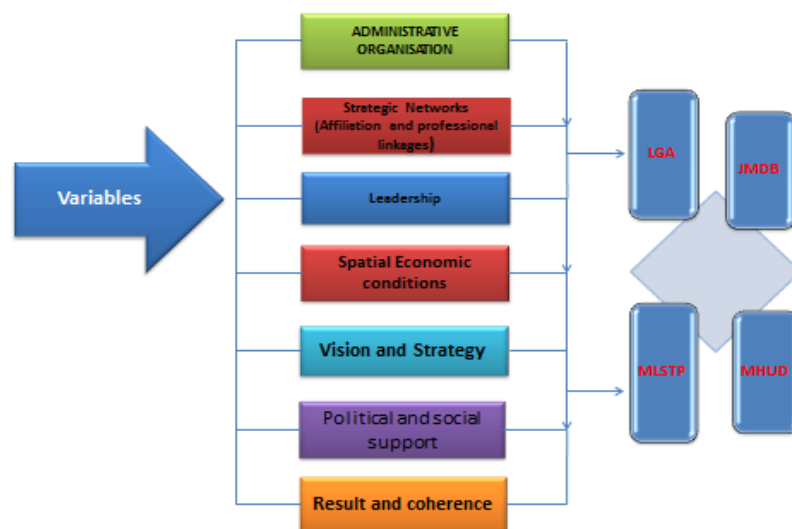


Figure 1: Functions, Roles and Responsibilities of Planning Authorities (Source: Authors Field work, 2012)

These authorities include Jos metropolitan development Board (JMDB), Ministry of lands, survey and Town Planning, Ministry of Urban development and the six departments of Land in the Local government areas carved into the metropolis. The authorities were established by law to manage the urban environments meeting Transport, Policing, Fire and emergency planning, Economic development, Planning, Culture, Environment and Health problems. These models of Planning authorities and agencies obtained from Jos Metropolis, Plateau state, Nigeria West Africa, Africa, are found in all the 36 states and the Federal capital Abuja, Nigeria.

These planning authorities under the 1946 Ordinance has outlined the task of the planning authorities in relation to their activities ensuring that there is no bridge in the distribution of basic infrastructure and development control. Oyesiku, (2004) observed that the adoption of master planning as a form of government intervention to control or influence development is a welcome idea. In achieving this objective, the authorities are expected to effectively control of any form of development. Since coming into effect, the planning legislations (the Lagos town planning Act of 1928 and the 1946 Nigerian Town and Country Planning Ordinance No. 4) that empowered the authorities to administer the laws, the authorities have been known to be in capable of performing effectively the statutory powers granted them by the laws.

Studies have shown that the planning authorities in Nigeria under the 1946 ordinance over the years have been concerned mainly with extremely few out of the wide range of responsibilities given to them under the laws (Ola, 1984;78-79; Oyesiku, 2004; Obateru, 2004; Lord,2012).

2.4 Constraints of Planning Authorities

A constraint is a restriction on the degree of freedom an organisation (Boards, Ministries and units) has in providing a solution (Design and Implementation of the master plan). It is basically a restriction to planning system in general and it is based on limiting resources, laws and regulations, and the need and eventually harms the planning system. A good plan will avoid undesirable consequences of any actions (Gupta, 2001; Goldratt, 2004).

Gupta (2001) , Qui,*et al.*, (2002) and DungGwom (2008) observed that constraints have helped to shape how policies are been considered and as a result he enumerated the following as constraints to any system; Political , Cultural, Institutional, Legal, Knowledge, Physical and Analytical constraint amongst others. In the design and implementation of any plan or policy (Master Planning), it very important that the potential constraints should be identified as it affects the various components individually for an effective development control in the area.

2.4.1 Causes of Constraints

Ripley & Franklin (1982) observed that constraints are caused by limited provision of one form of support or the other to the effective and efficient function of an organisation towards achieving its goal, depending on the nature of the constraints. The lack of Hierarchy, conflicts and compromise are some causes of constraints in planning authorities.

2.4.2 Lack of Hierarchy

The mode of interaction is one of bargaining and compromise, not one of order and obedience (Ripley & Franklin, 1982; Gupta, 2001; Goldratt, 2005). Even in those cases in which actors involved in the implementation are formally set in a hierarchical relationship the alleged superior often finds his or her will frustrated by the response and behaviour of the alleged subordinates. The personal values and preferences of individuals are they commanders or in the ranks are important influences on implementation. This goes a long way in constraining the passage of the plan or policy that have a good design and implementation. There is no hierarchy in the linking of the planning authorities, as a result of non- function institutional framework for the flow information (exchange of instructions, ideas) from bottom-up or Top-bottom.

2.4.3 Conflict and compromise

Cullingworth (1997) observed that compromise on the issues of policy or plan means accepting changed about an expect of legislation as the lack of compromise almost means lack of legislation. Consequently, individuals and groups who perceived themselves to be on the balance, winners or losers – at least some specific points have some compromise to make. It also goes to say that losers do not have to abandon hope and the winners cannot relax after their formulation and legitimating victories.

Different actors have influence on the outcome of the policy of plans. Implementation is a continuous process, with no clear-cut endpoint. It has the involvement of multiple actors such as individuals and organisations from territorial levels of government (Federal, State and Local government) as well as from all branches of government associations (Cook, 2000; Zhao & Yi, 2003). The action of Bureaucrats especially local civil servants is the most important in implementation. The role of private and nongovernmental actors is also prominent (Cook, 2000; Zhao & Yi, 2003). One major challenge of implementation is the context in which the plans are set. Plans are made by the state and it is expected to be implemented by the local government (Cook, 2000; Zhao & Yi, 2003). Both the state and local government get their subvention from the federal it is always the point of compromise.

2.4 Effectiveness of the Urban Master Planning system

In the assessment of the organizational effectiveness of planning authorities the most challenging problem of planners are first considered. There are no generally accepted conceptualizations prescribing the best criteria for measurement of effectiveness. Different organisational situations – pertaining to the structure, human resources and organisation's the performance as well as the impact of the organization's activities - required. The effectiveness of an organisation (planning authority) is determined by the effectiveness of its master strategy (master plan).

This is true because there are numerous ways of evaluating the organisations and these also have a reflection on the numerous subsections of the organisations. For the purpose of this study the system to be considered is the urban planning system which is made up of institutional, technical, administrative and the legal (laws and ordinances) which is generally an embodiment of regulations to achieve the stated goal of the planning system (Ripley & Franklin, 1982; Cullingworth, 1982; Hall, 2002).

The effectiveness of the urban planning system was considered based on urban governance (institutional), Urban management (Development control goals and measures) which is the technical aspect. The administrative structure operates using the legal (laws and ordinances)

Administrative regulations and guidelines are being written. Many who supported the original policy proposal did so only because they expected to be able to twist it in the implementation phase to suit purposes never contemplated or desired by others who formed part of the original coalition. They too seek a role in the administrative processes. It takes place through bureaucrats using bureaucracies (Ripley & Franklin, 1982; Cullingworth, 1997; Hall, 2002)

The action of Bureaucrats (Planners) is the most important in implementation. One major challenge of implementation is the context in which the plans are set. Plans are made by the state and it is expected to be implemented by the local government (Ripley & Franklin, 1982; Elbanna, 2007). Usually goals are vague to accommodate multiple points of view and translating the vagueness into specific concrete implementation actions renewing the potential conflict and compromise. The Effectiveness of the institutional component of the urban planning system is all about governance and how the planning authorities bring about good governance at all the levels represented in the jurisdiction. (Oyesiku, 2004; Obateru, 2004; Elbanna, 2007; Jiriko, 2008).

Operational Effectiveness is directly concerned with the management of the urban planning system. It uses the development control (goals and measures) which is the technical aspect to ensure that haphazard developments and sprawling conditions are avoided. The process of developing a plan seems to be dependent on experience even though the fault to such lies in the process of developing the plans. In order to move beyond the traditional method of preparing and implementing the plan and to ensure effectiveness in urban planning system through strategic planning a number of processes have to be involved by using the tools by adequate skill using all the technical potentials in the planning authorities, personnel, instruments, rules and regulations such as the development control (Ripley & Franklin, 1982; Mabogunji, 2001; Elbanna, 2009). Furthermore, the evaluation of the future of the or planning authorities is required in making correct assumptions about what the planning authorities will be like in the future (Elbanna, 2006). Broad-based involvement in discussing these issues is essential to the Strategy-Development process because success depends on the understanding and commitment of all the stakeholders in making the vision a reality (Elbanna, 2009).

This is very important in the development of the action plan and measurements to meet the problem identified in the urban system to make it very effective (Chaolin, Xiaohui & Jing, 2010). Consequently, implementation Plan includes a breakdown of: who will do it? What will be done? When it will be done? what resources are required? Unless the objectives identified in operational Effectiveness are translated into Action Plans, it is unlikely they will ever be reached. The documentation of the said plan is very important which will go a long way in ensuring that the correct plan is used for the specific area, remembering to define how to measure success (Elbanna, 2008). Instructions being passed from the top management officials to lower officials and ensuring the development control measures and goals are strictly followed.

The Legal section of the urban planning system becomes effective when the emphasis is placed on the planning legislation using the following regulations and laws addressing the physical planning problems identified in the urban areas (Obateru, 2004; Oyesiku, 2004; Ekop, 2007; Ekop & Uyanga, 2007). The component is made effective when the documents are adequately used for the regulations and control of development, these documents include; Development control standards, Constitution of the Federal republic of Nigeria (1999) amended, Land use decree 1978 (LFN, Cap 5. 2004) , Acceptable and responsive physical planning laws and regulations, 1992 Urban and Regional Planning Law, national Building code, Master plans, Development control measures; Zoning regulations, density control, building line regulation, height control act.

The usage of these documents is mostly manifested in a controlled development. The question is what is physical manifesting in the area of study? What are the reasons behind such physical development?

3 Research Methodology

The case study is adopted using the nested approach where nine planning authorities in Jos metropolis, Nigeria were convenience sampling technique was used, and one board, two ministries and six lands sections under the Works Department in the six local government areas in Jos metropolis, Nigeria, were selected for the study. Secondary data based on the characteristics and effectiveness of the master planning system were utilised for the study as observed by Dencombe, (2007), Yin (2009) and Dawson (2011). The purposively sampled was used to select the documents and Archival data that were used, see table 1.

Table 1: Multiple sampling techniques employed for the multiple research methods
(Source: Drawing from Grix, 2001; Denscombe, 2007; Dawson, 2011)

Sampling Method Adopted	Purposive Sampling	Convenience Sampling
Research method Adopted	Document review; Government Publications and official statistics, Journal papers, Newspapers and magazines, letters or memos, web pages etc	Nine (9) Planning authorities

The Approach for this paper is deductive and inductive, with a method of qualitative using secondary data (Jankowicz, 2000; Field, 2005; Saunders *et al.*, 2009). The method design adopted in this paper is the embedded Multiphase design. The carefully selection of this design is to match the research problem (Identifying and examining the characteristics of the master planning system and approach) and to make the study manageable and simple to present and describe as observed by Plano Clark & Creswell (2012).

The secondary data were obtained from the Archival data and documents such as the Town and country planning laws, 1946, Urban and Regional planning Law, 1992, Textbooks on Urban Master Planning Paradigm in Nigeria, and Readings in Urban and regional Planning, 2004, (Greater Jos Master plans (Past and proposed)), Jos Metropolitan Development Board (JMDB, 2006), Journal articles, conference papers

and satellite imageries amongst others (Marshall *et al.*, 1999; Grix, 2001; Ericksson *et al.*, 2008). Furthermore, observation was part of the data gathered which help to explain some planning processes in the planning authorities in Jos Metropolis.

Subsequently, detailed content and thematic analysis of the data from the data extracted from documents to determine the effectiveness of the master planning system and its approach in Jos that have informed the present state of urban morphology of the metropolis.

4 Findings and Discussions

For the purpose of this paper the discussion is going to be about identifying and examining the characteristics of master planning to assess the effectiveness of the urban planning system in Jos metropolis, Nigeria.

4.1 Identification of the characteristics of master planning

The master planning approach is characterised by the following See Table 2

Table 2: Characteristics of Master planning (Source: Local government Association, 2001; Mabogunji, 2001; ODPM, 2006)

1. For the restoration of human dignity through order to the city and to ensure planned present and future growth.
2. The creation of total physical environment which is functional, efficient, healthful and aesthetically pleasant for human activities.
3. It helps in policy effectuation at all levels of its application.
4. Though it has always been long- range, with the appropriate phasing, the plan is said to provide a task for each period within its implementation period.
5. It serves as practical working guide to the legislators in making everyday decision (Black, 1975:13).
6. That through it politicians can know the articulated priorities of the communities on that basis.
7. Master plan has been associated with proposal for restructuring existing urban areas and cities.

Table 2 shows that the first characteristics of the master plan intends to bring about the restoration of human dignity through ensuring order to the city and to ensure planned present and future growth. At this point master plan presumes that the purposes, needs and situation of a sizeable and complicated city can be conceived, projected, foreseen, and pre-determined within 20 or no less than 50 years. These can be constraints by many factors and makes it very difficult to be feasible.

The master plan is characterised by the creation of total physical environment which is functional, efficient, healthful and aesthetically pleasant for human activities. This does not really hold as it is an end –state concept which assumes that people’s desires, objectives and priorities are sufficiently known and fixed to permit drawing conclusions today with certainty concerning what they will want a half century hence – or that city planners alone are wise enough and will be allowed to do this for people. Cities are dynamic and change always as a result of the provision of more basic infrastructure. Physical constraint can inhibit the urban planning system, besides provision the policy has always been urban bias.

Master plans have been considered to be helpful in policy effectuation at all levels of its application. This has not always been the case because it presupposes that no

unexpected events or developments will take place which makes it imperative or desirable to alter the plan repeatedly. Consequently, in the case of Jos Metropolis, Nigeria the master plans identified for three different locations at state and local government levels have not been implemented 3-5 years after designed. Every time policy makers create a government program, the program creates its own constituents. As a result, even when its utility is in question, closing it down often becomes nearly impossible. This has always been the major constraint experienced by many countries in trying to implement their policies as observed by Gupta (2001) and Goldratt (2004).

Though it has always been long- range, with the appropriate phasing, the plan is said to provide a task for each period within its implementation period. It implies that people want to or will themselves a quarter to a half century in advance. However, very few democratic societies will commit themselves to a completely planned end-state to be attained 20 or more years from now. Due to the dynamic nature of the urban system in Jos metropolis, delay in the passage of the master plan into law, and waiting for the long period, it is always taken over by so many events, making it irrelevant to control growth and development.

Master plan serves as practical working guide to the legislators in making everyday decision about physical planning problems and knows the articulated priorities of the communities on that basis (Black, 1975:13). It assumes that someone or group of persons has the knowledge and technical capability to analyse all important elements and aspects of a city, project them in concert, identify and quantify their numerous interactions and explain the results and significant alternatives to the relevant bodies for intelligent reaction and collective decision; that this complete analysis will be accomplished promptly such that the data underlying the master plan are still valid at the time of decision and many more of such problem that affect the master planning from being implemented appropriately. This to a large extent is what is obtainable in Nigeria.

There is a clarion call for an appropriate physical planning approach to address the problem in Nigeria using Jos Metropolis to have an in-depth understanding of the problem. Spatial planning is a new approach to the African continent and Nigeria as a country. It is characterised by Dynamic, timely policy & decision making, Inclusion & effective community engagement, collaboration, integration and joining –up, Positive, evidence-based reasoning, Outcomes and delivery, Urban sustainable development and Climate change amongst others. It is altogether very flexible and the complete opposite of the master planning approach. This is very important and timely considering the dynamic nature of the Nigeria urban and regional population.

4.2 Effectiveness of the master Planning system

The effectiveness of the master planning system in Jos metropolis is nothing to write home about due to the presences of numerous constraints which include; Political, institutional, cultural, financial, Knowledge, analytical and physical constraints amongst others.

The management of the urban planning system is carried out through the planning authorities using the master plan. This is use as a guide for development control (goals and measures) which is the technical aspect to ensure that haphazard developments and sprawling conditions are avoided. The process of developing a plan seems to be

dependent on experience even though the fault to such lies in the process of developing the plans. Organizational effectiveness is the concept of how effective the planning authorities are (Ministries, Board and sections of Land) achieving the outcomes the organization intends to produce (Etzioni, 1964). The idea of the effectiveness of planning is especially important for non-profit organizations as most people who donate money to non-profit organizations and charities are interested in knowing whether the organization is effective in accomplishing its goals or not. In this instance it is the planning authorities ensuring the coordinated urban development within the jurisdiction of the Jos Metropolis, Nigeria. See figure 1

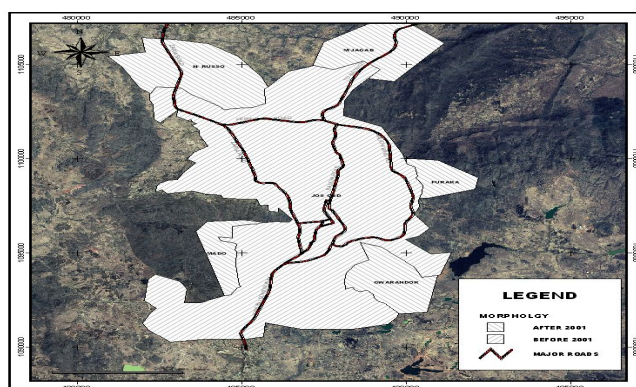


Figure 2: Imagery showing changes in morphology of the Jos metropolis. Before and after (2010). (Source: Wapwera & Dungwom, 2009)

Figure 2 shows that along Bauchi Ring Road (Furaka), Tudun Wada Ring Road (Mado), Gwarandok, Naraguta Russuo, and Gidan moi Jagab are emerging settlements. These settlements are characterized by inadequate drainage system, poor access roads, and haphazard developments, substandard materials used for buildings, poor utilities, services and facilities because the planning authorities and the planners in the authorities were unable to ensure proper development control which leads to a bulging of the boundaries of the study area, over the years using the master planning approach (Greater Jos Urban master plan 1975-2005 & 2008-2025; Wapwera & Dungwom, 2009).

According to Richard et al. (2009) effectiveness of planning authorities captures performance plus the plethora of internal performance outcomes normally associated with more efficient or effective operations and other external measures that relate to considerations that are broader than those simply associated with only economic valuation (either by shareholders, planners, or developers inhabitants), such as corporate social responsibility (Richard et al. 2009).

The effectiveness is also dependent on its communicative competence and ethics of the planning authorities. The relationship between these three is simultaneous. Ethics is a foundation found within planning authorities to determine effectiveness. Planning authorities must exemplify respect, honesty, integrity and equity to allow communicative competence with the public (Etzioni, 1964; Richard et al. 2009). Planning authorities, have a way of generating funds and also have votes and budgets from the government which they use for their day to day running (Cohen, 1988).

The effectiveness of planning authorities is an abstract concept and is basically impossible to measure. Instead of measuring the effectiveness of the planning

authorities determines proxy measures which will be used to represent effectiveness. Proxy measures used may include such things as number of people served, types and sizes of population segments served, and the demand within those segments for the services the planning authorities provide and ensure proper development control (Etzioni, 1964; Cohen, 1988; Richard et al. 2009). In view of the consideration for the planning authorities and agencies as well as the board in the study area the effectiveness is measured on the planning system being practiced in the area, considering the fact that the master plan that the system promotes has not been successful over the year. Since the organization has as its goal the implementing the master plan, it measures its organizational effectiveness by trying to determine what actual activities the people in the organization do in order to bring about homogenous development in the urban environment under the Jurisdiction of the planning organizations. Activities such as on the Job- training are important because they provide the support needed for the planning authorities to deliver their services but they are not the outcomes per se. These other activities are overhead activities which assist the planning authorities in achieving their desired goals. The term effectiveness of planning authorities is often used interchangeably with authorities development, especially when used as the name of a department or a part of the Human Resources function within an organization. Furthermore, public policies are constrained ultimately by people's present knowledge, because more knowledge about the world abounds, the realisation of the failings of past policies, which could be observed from figure 1. Caution is taken more about the world around about the failings of past policies as observed by Gupta (2001). That notwithstanding the planners lacks the technical knowledge of satellite imaging and observation to monitor the growth and development within their jurisdiction.

Analytical techniques tapped for public policy/ plan analysis, either at the design stage or at the implementation stage, use numbers. The statistical methods or the various techniques researchers used in analysis could exclude the impartiality of scientific reasoning. Analytical constraints may creep into the analysis from a number of sources, hence affecting or restraining a number of issues relating to the plans either in the design or implementation phase (Hull, 1995; Gupta, 2001; Goldratt, 2004). The question in the research is that what is the constraint pose by the analysis at the design and implementation state of the master plan? The answer is very clear, there exist a lot of constraints yet, the problem has not be addressed because the master plan is not an appropriate approach of planning for developing countries and urban cities in them because it is not designed for a dynamic population such as those obtained in most developing countries. From the discussion of the findings about the identified characteristics of the master planning approach it could be seen that the conventional concept of master planning has been; plagued with a number of questionable conclusions and this has affected the performance of the planning authorities in Jos Metropolis Nigeria, making them not effective in achieving their goals.

Finally, considering the characteristics of the master planning, it is clear that it is out dated and becoming irrelevant in meeting the need of most urban areas in developing countries as the process through which they are design and implemented are unending, too bureaucratic, cumbersome. The processes and procedures involved for the consideration in the judiciary it takes a long period of time and before it is adopted and pass to law, it has become obsolete and because master plans are rigid by their

nature. Whilst these plans require longer time to be considered, developments are not static and the plans have no consideration for the inclusion of other policies.

5 Conclusions and Recommendation

This paper has critically assess the master planning system and its constraints on planning authorities in Jos, metropolis Nigeria, by identifying and examining the characteristics as well as the effectiveness of master planning system in Jos metropolis. Having operational land use management policies which will help planners provide liveable environments for urban residents is very important but having to achieve through a good people-oriented design and government willingness to be part of the effort. The following conclusions were arrived at:

- The master planning system and approach is an out-dated means of planning as it is design for a static or slow growing population such as that obtained in developed countries where population and physical developments are controlled.
- The planning approach has not been effective for the Jos metropolis to allow the needed growth and development, from the previous greater Jos urban master plan to the present owing to the fact that, developing countries such as Nigeria and Jos Metropolis to be specific has a high rate of growth and development that is not controlled.

Base on the aforementioned, the following recommendations were offered to guide future urban development in conformity to the growth rate within the region;

- There should be the immediate adoption of Spatial planning based on its comprehensiveness, flexibility, timeliness and people-oriented approach
- There should be regular updating of these Master plans, planning laws and decrees or better still adopt a better planning approach e.g Spatial Planning with its interventionist character.

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Road User Charging Impacts in Libya – Perceptions from Drivers

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Abstract

This paper studies the perceived impacts of road user charging (RUC) on drivers daily activity travel patterns in urban areas by using one of the large Libyan cities (Benghazi) as the case study. The analysis uses full parametric hazard models and data from a field-based RUC experiment that was conducted in Benghazi. The database consists of activity-based travel durations. This paper focuses on the analysis of the durations of drivers travel-to-work trips and addresses the changes on the patterns of driver's trips over the study period to investigate the differences attributable to origin (home-based), time, gender and age as a result of the RUC impacts. The results indicate that RUC can have a positive impact in reducing traffic congestion with reduction of driver's trips crossing restricted areas during peak period by around 35.5%. The paper concludes that RUC could serve as a good instrument in reducing traffic congestion and in improving the environment in city centre of Benghazi. The results could be of benefit to transport policy makers.

Keywords

Activity-based travel, Road charging and hazard models.

1. Introduction

Road-user charging (RUC) can be defined as a method of collecting money from road users. Whittles, (2003) defined road pricing as an asset of ideas that can be applied in urban areas to charge road users particularly when they drive in urban areas. RUC is considered as a practical technique used to solve or reduce traffic congestion and transport problems. To create charging policy that is effective against congestion, some trips would have to be cancelled, while others would have to adapt their mode of travel, destination, frequency or time of travel. This would mean a change both in the lifestyle and style of travelling of an individual or the whole household, and the change involves rescheduling activity patterns, in terms of where, when, how, and with whom these activities are scheduled during the day or week, in order to achieve their desired activity participation (Bowman and Ben-Akiva, 2001). Many studies have used an activity-based approach to analyse the impact of road user charging on activity travel patterns using travel and activity data. Moreover, various field-based charging experimental studies have been done by investigating the user's behavioural response toward the hypothetical introducing of road user charging policy. For instance, Hug et al.,(1997), Thorpe & Hill (2003), Francsics (1998), O'Mahony et al., (2000), Nielsen (2004) and Chow (2006) are the most studies that examined behavioural responses toward RUC and provided detailed information on how users could adopt their travel patterns over time in response to RUC. The common positive

aspect of these field experimental studies is the use of real budget to achieve more realistic decision from the participants. This process of using real budget helps the researcher to enhance the validity of the experiment. Other worthy points are the use of peak period toll hours which are the effectiveness time that can be used for charging, point-based or cordon-based charging as the type of charging, multi-days data by recording activity travel data for two periods before and after introducing of road user charging.

In this study the approach pursues the examples that stated above by using a field-based RUC experiment, pre-paid experiment budget, cordon-based charging, morning peak period toll hours and multiple activity travel data (7days before and 7days after the introducing of RUC) to ascertain and document the perceived impacts of RUC on individuals activity travel patterns in Libya cities for a sample of 120 participants for the real experiment and 60 participants of another sample that uses as a control group.

2. Hazard-Based Duration Models

Hensher and Mannering (1994) were one of the early advocates of applying hazard models to travel demand and activity duration modelling. Bhat (1996) stated that hazard duration models are regarded as a useful tool that can be applied to activities and there is much evidence to suggest that the hazard theory is an appropriate tool for investigating parameters that influence changes in both activity type and the consequential demand for travel. Zhong and Hunt (2005) examined household weekend activity durations using hazard-based models. This work suggested that a fully parametric hazard model can be considered as a suitable model for activity and travel related modelling. Also, Zhong *et al.* (2005) showed that the four most widely used distributions of a fully parametric hazard are Weibull, Exponential, lognormal and loglogistic. Moreover, the hazard function can be used as a tool to compare different scenarios so that their differences can be highlighted. In this study, the analysis focuses on the comparison of the hazard function of travel-to-work trips collected as part of the field based RUC experiment. The analysis will seek to develop a deeper understanding of the changes that have taken place in the duration of the travel-to-work trips of the field-based experiment that conducted during two weeks in May, 2008 in Benghazi, Libya.

The next section of the paper provides a brief description of the data used in the analysis then explores which of 11 parametric models best fits the data used in this work and then presents the results. The analysis firstly looks at the entire data set collected over the study period to explore differences due to trip origin, gender and mode choice. Lastly conclusions are drawn.

3. Description of the Travel Data

As stated above, the data used in this study were gathered by the researcher using field-based road user charging experiment in May, 2008 in Benghazi, Libya. In total, 81 driver's respondents completed the survey during the two weeks period; the sample size of the control group respondents was 36. The database consists of information regarding travel-related activities (activity travel diary) and individual and household information. The travel related activity data includes a range of trip information including origin, destination, mode of travel, journey purpose and start and end time for two weeks. Figure 1 explain the main features of RUC experiment that conducted in Benghazi, including the location of the cordon, type of charging

scheme, restricted hours, enforcement system, toll level, type of data and type of sample.

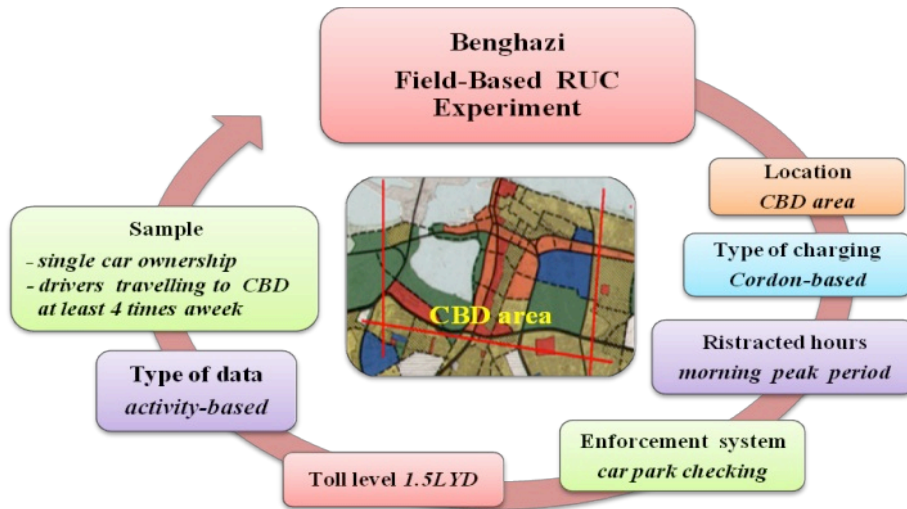


Fig. 1: The key features of road user charging experiment

4. Preliminary Findings of Road User Charging Impacts on Activity Travel Patterns

According to the field based RUC survey, the preliminary results show that;

- Around 68% (55 drivers) of the 81 drivers chose to pay the toll. A number of 46 drivers of the 81 (57%) chose to pay the charging toll on all the days of the experiment, however, 9 drivers of 81 (11%) chose to pay the toll for 3-4 days of the week. On the other hand, 26 drivers of 81 (32%) did not pay the toll at all and avoided the payment by choosing another alternative.
- During the first week of the study survey, drivers made a total of 2023 trips (or 25 trips per person per week, 3.5 per person daily, these results are mostly different with the previous results of Doxiadis (1989) that have been stated that it is about 1.8 trips per person daily. However, in the second week, the number of trips decreased by 3.3%. In the first week, the majority (97 %) of trips were by cars and only (3 %) of trips by other modes of travel. From these, one can see that the car was used as the main mode of travel for all the trips types. The daily travel patterns is classified into six trips types with respect to the “work” and “home” location namely; home-based, work-based, shopping-based, recreation-based, visiting-based and others-based that involve other different activities places .
- Figure 2 shows that in the first week, the half (50%) of driver’s trips were home-based trips, while nearly one-third (30%) were work-based trips, around 7% were shopping place-based trips, 5% visiting places-based trips and 3% recreation-based trips.

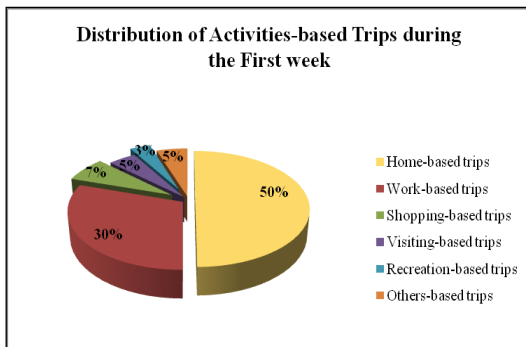


Fig. 2: Distribution of activity-based trips during the first week

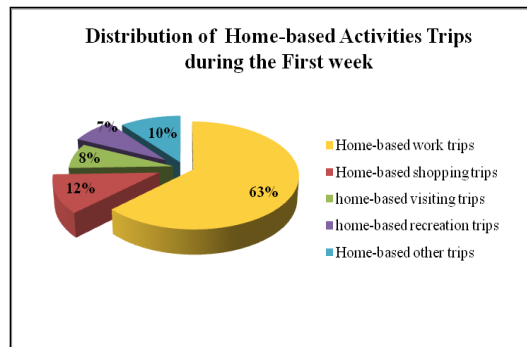


Fig. 3: Distribution of home-based trips during the first week

- From figure 3, one can see that in the first week the drivers made a total of 1006 home-based trips. Of these, 63% were home-based work trips while nearly one-third were home-based non-work trips such as home-based shopping trips 12%, home-based visiting trips 8%, home-based recreation trips 7% and home-based others trips 10%.

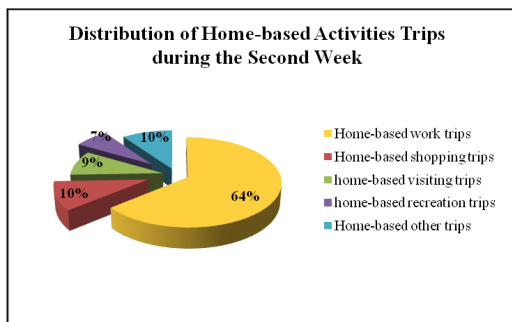


Fig. 4: Distribution of home-based trips during the second week

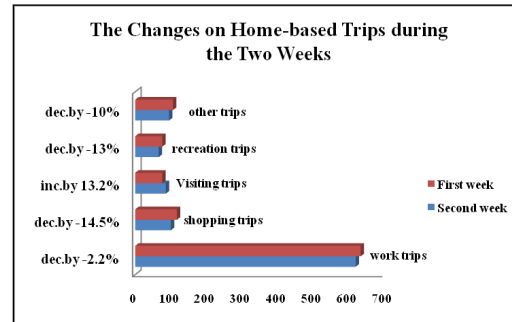


Fig.5: The changes on home-based trips during the two week

- Number of activity-based trips, and home-based work trips represent nearly two-third of all home-based trips. These results are generally different with the previous results of Libyan studies that have been stated that around 49% of trips are home-based travel to work trips (Doxiadis, 1989).
- Figure 4 illustrates the changes that have accrued on home-based activity travel trips during the second week. Furthermore, even though the percentage of home-based travel to work trips has slightly increased during the second week (as can be shown on figure 4), Figure 5 represents that the number of travel to work trips has slightly decreased by 2.2%. Home-based shopping trips have decreased by 14.5 %, home-based recreation trips have decreased by 13%, and on the other hand home-based visiting trips have increased by 13 %.

5. Using Hazard-Based Duration Models to Explain Changes in the Duration of Activity Travel during the Field Experiment

As mentioned previously, survival models or hazard-based duration models are common terms for the collection of models that characterise a probability distribution of the positive random variable T . A review of the literature indicates that while Hensher and Mannering (1994) started to present hazard-based duration models to travel demand modelling in a general way and gave an overview of the applications of these models to transport problems, a number of researchers tried to describe and analyse activity-based duration using hazard-based duration models. Safour (2012) explained the steps in the hazard model approach that applied in this section by clarifying the hazard theory and hazard functions also the steps in the application of the hazard theory.

5.1. Exploring the shape of the probability density function for durations of travel to work trips in the first week

According to Pas (1996), MOTOS Handbook (2008), and Statsoft (2008), there are three families of hazard duration model that can be applied to trip activity; fully parametric, semi-parametric and non-parametric. According to MOTOS Handbook (2008), and Statsoft (2008) the factor that determine the applicable method of hazard is the size of the sample of data, for instance, if the sample is large enough (e.i., 100 and more) the three families of hazard can be used. However, if the sample is small, then these three families can be applied if the data has normal distribution, otherwise, fully parametric hazard model is the suitable method to applied for a small number of observations.

In this study, a full range of parametric functions were considered in the analysis of individuals daily travel durations in Benghazi during the first week of the field experiment. Examples of parametric models include Exponential, 2-parameter Exponential, Weibull, 3-parameter Weibull, Normal, Lognormal, 3-parameter Lognormal, Logistic, Loglogistic, 3-parameter Loglogistic and Smallest Extreme Value. According to Hensher and Button (2000) and Zhong *et al.*, (2005), the four largely used distributions in activity-based modelling are Weibull, Exponential, Lognormal and Loglogistic. Generally, the best fit model of these 11 models are identified based on various tests such as, the likelihood test, Anderson-Darling test and the Correlation Coefficients test (Hensher and Button, 2000). In this study the Anderson-Darling (AD) test and the Correlation Coefficients (COR) test have chosen to evaluate the fit model. Zhong *et al.*, (2005) mentioned a low value of the AD test and a COR value closest to 1 identify the best-fit model. As illustrated in Table 1, a 3-parameter lognormal distribution has the lowest value of the AD test and the highest value of the COR test for travel work trips, followed by the Lognormal distribution. However, the 3-parameter Lognormal has a negative threshold which has no meaning in the context of duration of travel. Therefore the lognormal option is selected here as the best fit model.

According to the above explanation, the next step was to check that the best fit model for the data for each week separately. The six most promising parametric distributions have been considered and the results presented in Table 2. All of these distributions have positive parameters with the threshold equal to zero. By comparing AD and COR values in Table 2, it is clear that the Lognormal distribution (statistically) is the

best suited distribution for the data, with the Loglogistic function having a similar performance. These two distributions were cited in the four (Weibull, Exponential, Lognormal and Loglogistic) highlighted by Zhong (2005) and consistent with the Weibull distribution considered by Oh and Polak (2002). On the basis of this evidence the Lognormal distribution was adopted as the basis for this study.

By normalising the data it is possible to compare the disaggregated datasets and thus begin to understand the changes in travel work trip durations that have taken place over time and depending on other parameters such as time of travel, mode choice, and gender.

Table 1: Goodness-of-fit tests for duration of travel to work for the first week

Distribution	Test Statistic	
	AD	COR
Weibull	56.877	0.897
3-parameter Weibull	24.868	0.914
Exponential	183.45	-
2-parameter Exponential	117.95	-
Normal	33.140	0.907
Lognormal	24.001	0.949
3-parameter lognormal*	23.775	0.949
Logistic	27.994	0.947
Loglogistic	83.873	0.811
3-parameter loglogistic *	26.58	0.947
Smallest extreme value	83.873	0.811
Best-fit model	lognormal	

* These distributions generate negative thresholds.

Table 2: Goodness-of-fit tests for duration of travel to work for the data of two weeks

Distribution	Test Statistic Value			
	Week 1		Week 2	
	AD	COR	AD	COR
Weibull	56.877	0.897	19.637	0.934
Exponential	183.45	-	103.77	-
Normal	33.140	0.907	14.870	0.948
Lognormal	24.001	0.949	12.006	0.954
Logistic	27.994	0.947	18.317	0.939
Loglogistic	83.873	0.811	15.581	0.947
Best-fit model	Lognormal			

According to the Handbook (2008), and Statsoft (2008), the Lognormal probability density function $f(t)$ is given by:

$$f(t) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\frac{(\ln t - \mu)^2}{2\sigma^2}\right], t > 0 \quad (1)$$

The cumulative distribution function $F(t)$:

$$F(T) = \int_{-\infty}^t \frac{1}{\sigma t \sqrt{2\pi}} \exp\left[-\frac{(\ln t - \mu)^2}{2\sigma^2}\right] dt \quad (2)$$

The survival function is $S(t)$

$$S(t) = 1 - \int_{-\infty}^t \frac{1}{\sigma t \sqrt{2\pi}} \exp\left[-\frac{(\ln t - \mu)^2}{2\sigma^2}\right] dt \quad (3)$$

Where: μ = the location parameter ($\mu > 0$), and
 σ = the scale parameter of the distribution ($\sigma > 0$).

Using the Lognormal density function the hazard theory is applied to total sample sets to develop the baseline results which are presented in Section 3.

6. Baseline Hazard for Travel to Work Trips Durations

As mentioned previously, hazard-based duration models will use to explain the changes on the travel patterns of commuter trips during the peak period of RUC experiment using a fully parametric method and Minitab software. To describe the hazard functions that used a number of Figures will illustrate the different situations of peak period travel using durations of travel to work trips.

6.1. Baseline hazard for travel to work trips durations in the first week

To explain the travel to work trips during the first week in the peak period a set of durations of trips of travel to work (commuter trips) has been applied using hazard based duration models. As mentioned above in table 2 the lognormal distribution is the best fit distribution.

Firstly, as can be seen Figure 7 shows the probability density function (a), goodness of fit (b), survival function (c) and the hazard function (d) for travel or journey to work trip durations that conducted by the drivers participated in the first week of the study during peak period using the Lognormal distribution which is according to the AD and COR tests the best fitted model for the first week data. It also includes the parameter estimates and calculated statistics. Interpretation of these functions can be explained using the duration of 20 minutes of travel to work trips. It can be seen that the probability density function shows that 56% of travel to work trips have duration of 20 minutes. The goodness of fit plot (with correlation $R = 0.94$) indicates a very high degree of correlation between the lognormal distribution and the observed values. The largest deviation occurs for the shorter and longer journey times.

From the survival function (c) one can see that less than half of travel to work trips have a duration greater than 20 minutes and more than the half have durations less than or equal to 20 minutes. The hazard function presents the ratio of the probability of a given trip duration relative to the total number of trip durations greater than this particular duration (d). Longer and shorter duration trips than the duration at the maximum hazard value (here about 20 minutes) are more likely to remain because the hazard (the prevention or disincentive) is lower.

The discussion of each step of the hazard theory has been presented here for clarity and to ensure understanding of the basics.

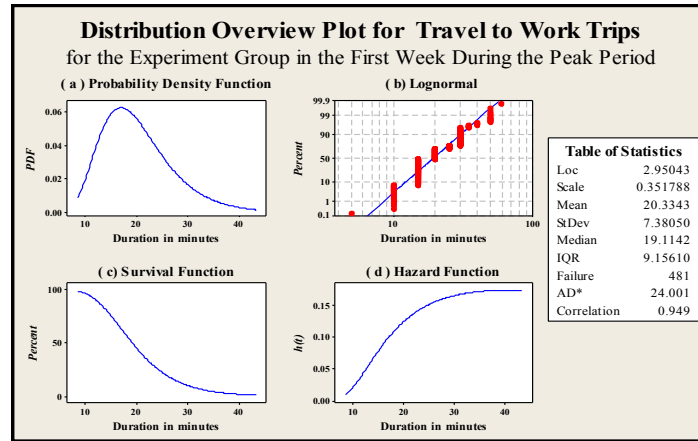


Fig.7: Distribution overview plot for duration of travel to work in the first week

6.2. Baseline hazard for travel to work trips durations in the first week compared to the second week during the peak period

To investigate the changes that occurred on travel patterns during the second week of the field experiment of RUC, and according to the goodness of fit test the data of trips durations of travel to work during the peak period have applied using the baseline of hazard model and lognormal distribution which is the best fitted distribution for the field experiment data (Table 3). Figure 8 shows the baseline hazard for durations of travel to work trips for the first week trips compared to second week trips during the peak period using two types of data (durations of trips by cars and durations of trips by other travel modes). The differences in the baseline hazard for travel to work trips in the second week during the peak period using cars and all other modes of travel and first week trips are evident from the Figure.

In general, for the first week, the hazard rate is higher for trips longer than about 12 minutes compared to second week trips durations for cars and other modes. The reverse is true for shorter than 10 minutes durations. This means that the disincentive to first week trips compared to the second week is respectively higher, and lower for shorter than 10 minute trip durations suggesting that the longer trips for the second week have more chance of surviving than for first week. This is counter intuitive result that indicates the most changes which have made during the second week were on the shorter trips more than longer trips.

Table 3: Goodness-of-fit tests for duration of travel to work for the second week trips using different modes

Distribution	Test Statistic Value			
	Week 2 (all mode trips)		Week 2 (car trips)	
	AD	COR	AD	COR
Weibull	19.64	0.934	30.32	0.907
Exponential	103.77	-	103.3	-
Normal	14.87	0.948	18.83	0.920

Lognormal	12.01	0.954	14.63	0.951
Logistic	18.32	0.939	21.58	0.914
Loglogistic	15.58	0.947	18.11	0.940
Best-fit model		Lognormal		

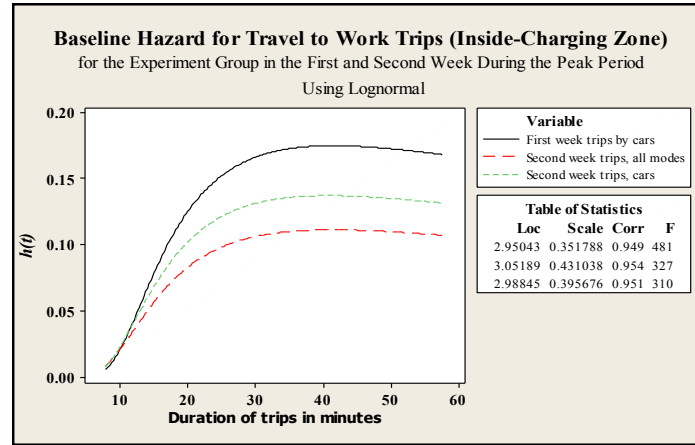


Fig. 8: Baseline hazard function for durations of travel to work trips in the first and second weeks using different modes of travel.

As stated above, the differences in the baseline hazard for durations of travel to work trips in the second week during the peak period using cars and other travel modes and first week trips is very clear. The Figure shows that the shape of the hazard function for car trips during the second week are (as expected) different to the hazard shape for all modes trips; however, the difference is less than the difference to the first week cars trips. This is changes due to the fact that travel to work trips by car has shorter durations of travel than others modes trips such buses.

Moreover, in the second week car trips there was an increase in the hazard for shorter durations with change from all modes trips. Also, it is clear that the maximum value of hazard rate has reduced for all modes trips during the second week suggesting shorter trips are surviving. The hazard curve again increases shifting slightly to higher deviations for cars than other modes.

6.3. Baseline hazard for travel to work trips durations for the control group

Another suggestion can be used to realise the changes that occurred during the second week after introducing the RUC scheme is the comparison study between the travel patterns of real experiment group (participated drivers of RUC experiment) and travel patterns of the control group (normal drivers). Firstly, the study will use the control group data to recognise the main changes in the travel patterns during the two weeks of the study and Table 4 provides that the Lognormal distribution is the best suited distribution for durations of travel to work trips for the control group data during the peak period for the two weeks. From Figure 9, it can be seen that the shapes of the three functions; probability density function, survival function and hazard function are quite different for the first week trips of the control group and the second week. The control group trips trends are steady for the two weeks. This suggests that in general shorter and longer trips for the control group for the two weeks are remained without

any changes compared to travel to work trips for the real experiment group which have significantly difference. This has been shown in Figure 8 for the real experiment group trips in second week, the longer trip durations have become longer and this due to the fact that a number of drivers who driving for short term have a chance to change their mode of travel from cars to other modes such as buses (which can be explain in more details by Figure 10 (a) and (b)).

Table 4: Goodness-of-fit tests for durations of travel to work for the control group

Distribution	Test Statistic Value			
	Control group		Control group	
	Week 1		Week 2	
	AD	COR	AD	COR
Weibull	12.76	0.930	17.68	0.918
Exponential	75.15	-	76.6	-
Normal	8.62	0.951	11.24	0.940
Lognormal	7.42	0.954	9.17	0.949
Logistic	11.2	0.934	14.13	0.925
Loglogistic	9.49	0.938	11.62	0.935
Best-fit model	Lognormal			

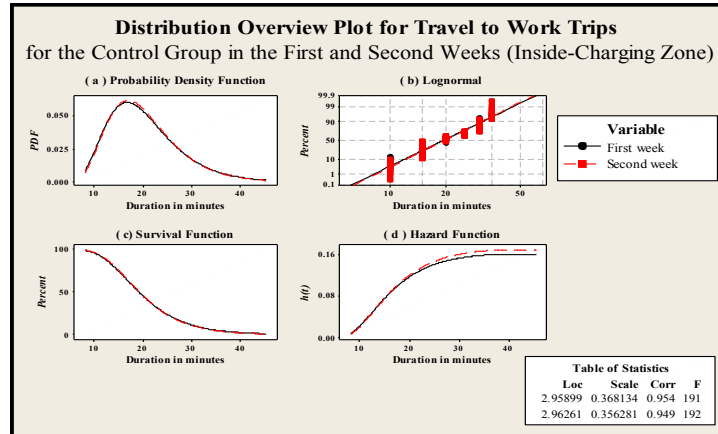


Fig. 9: Distribution overview plot for duration of control group travel to work trips

6.4. Baseline hazard for travel to work trips durations for real experiment and control groups

In an attempt to gain further understanding of the changes of travel to work trips during the peak period of the field experiment of RUC using cars, control group trips were applied to compare with real experiment group trips. The results are presented in Figures 10(a) and (b). Figure 10(a) shows that the shapes of the hazard functions are quite similar for both experiment group and control group durations trips during the first week. A very little difference in the hazard rate of long durations for the experiment group durations trips where the hazard was higher.

It can be seen that the hazard rate dramatically increases with increasing trip duration until the trip duration reaches approximately 30 minutes. After that the hazard rate

gradually steady with increasing durations of trip. However, the hazard values for the experiment trips a little bit higher than the control group trips for trips with 20 minutes durations and more. This suggests that in general longer trips for control group were much than longer for real experiment group trips comparing to the shorter trips for both groups. This suggested that the long durations trips for the control group more than durations trips of the experiment group comparing with the shorter trips. However, it is clear that the second week changes are quite different. The hazard values for the control group trips are higher than the experiment group trips.

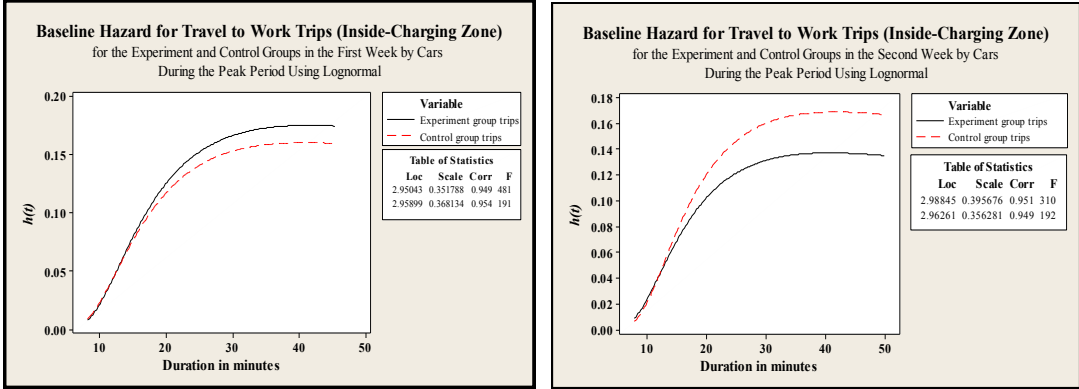


Figure 10(a): Baseline hazard for peak period trips in the first week for real experiment and control group

Fig. 10(b): Baseline hazard for peak period trips in the second week for real experiment and control group

As has been seen from Figure 10(a) and (b) the shapes of hazard rates for the two weeks trips for the control group are similar. This suggests that the changes that occurred only with the real experiment group trips as has been shown in Figure 10(b). The decrease of hazard values for the real group trips in the second week means the decrease was in the trips of shorter durations. Also, it is clear in Figure 10(b) that the changes of hazard values starts from 15 minutes durations where the hazard curve increases slightly to higher deviation. This effect evident over such a short term is surprising because charging scheme effects are more likely to take place over shorter trips more than longer trips.

7. Conclusion

RUC is considered as a practical technique used to solve or reduce traffic congestion and transport problems. In Benghazi field-based RUC experiment the results stated that during the restricted hours, RUC policy can have a positive impact in reducing traffic congestion with reduction of car trips crossing restricted areas during peak period by around 35.5%. The results proved that the lognormal distribution presents the best fit for the journey-to-work trips data. The hazard function was used to gain a fundamental understanding of the characteristics of the changes in the patterns of travel during the study period have been presented. The research has indeed shown that the hazard theory does highlight interesting features that prove the positive impacts of road charging policy.

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Carbon Emissions, Transport and location: A sustainability Toolkit for Planners in Urban Development

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Abstract

The objective of this paper was to devise a tool to assist urban planners in the environmental component of decision making for the location of workplace destinations. It examines the transport related carbon dioxide (CO₂) emissions generated per person travelling to workplace destinations in the Greater Dublin Area (GDA). The research was carried out based on the following datasets: (i) Central Statistics Office (CSO) 2006 Place of Work Census of Anonymised Records (POWCAR) and (ii) CO₂ emissions per mode of transport. A model was created combining the datasets within a 250 metre grid square coding of the GDA. The calculations produced by the model were analysed spatially and numerically using geographical information systems (GIS) software. The results reveal a link between the location of workplace destinations and the carbon emissions generated per person travelling to that location. Work place destinations within close proximity to a range of public transport options demonstrate significantly lower CO₂ emissions than those in more out-of-town locations. The model can form the basis of a tool to assist urban planners in the environmental component of decision making for the location of workplace developments. The implication of the tool is that it can allocate a ranking to locations based on their sustainability from a transport perspective.

Keywords

Transport; Carbon Dioxide (CO₂) Emissions; Geographical Information Systems (GIS); Model; Sustainability Indicator

1.0 Introduction

Over 569,000 people travel to work in the Greater Dublin Area (GDA) every day (CSO 2006). This paper reports a destination based assessment of the carbon emissions associated with these journeys. A model was developed which implements this on a fine-grained basis comprising grid squares of 250 metres by 250 metres to evaluate carbon emissions associated with the journeys. The main purpose of the model is to determine the carbon emissions per person at 250 metre grid square destination level. This is to show the environmental impact of land use at various locations in as quantitative a manner as possible. This scientific indicator can assist in the evidence based decision making component of how land is used. This methodology has been researched and implemented such that it can deliver that objective.

Carbon dioxide (CO₂) is a product of combustion, especially of fossil fuels, and is emitted by engines and power plants that use such fuels. Anthropogenic CO₂ is cited as one of the most significant contributors to global warming. A recent report prepared by the OECD (2009) states that Ireland must take significant steps if the commitment to reductions in CO₂ emissions under the Kyoto Protocol are to be met. The report goes on to state that Ireland's agri-food and transport sectors will be responsible for 70% of all CO₂ emissions outside the emissions trading scheme (ETS) by 2020 (See figure (1) below). The role played by location, within the office development sector for example, in influencing CO₂ emissions is explored and illustrated in this paper providing planners with clear guidance.

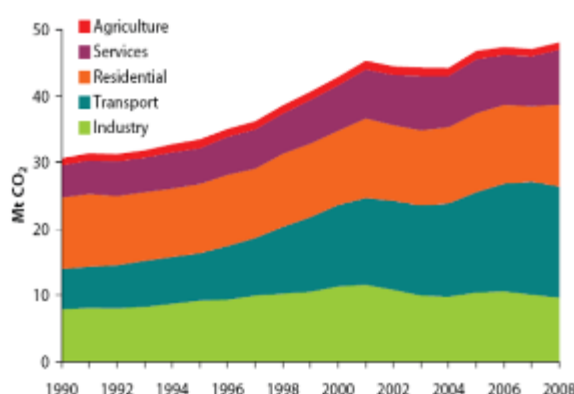


Fig. 1: Primary Energy Related CO₂ by Sector 1990 -2008 (Source: Howley et al. 2009)

2.0 Literature Review

Sustainability eco-labelling rating systems for buildings, for example BREEAM (2011), primarily focus on the fabric of the building itself. According to Dixon (2009) there is scope to review these rating schemes and focus on the location of workplace buildings as a benchmark for sustainability. This is upheld by Wyatt (2011) whereby he notes that the environmental performance of a building needs to be measured beyond the operation of the building itself and linked to commuting related energy consumption. In his analysis of this issue Wyatt cites location in relation to potential public transport systems as a means of restricting this type of energy consumption.

Location is central to the real estate industry (Geltner 2007). However, sustainability is not typically factored into the choices being made for the location of the office (Dixon 2009). Locational preferences are made based on end user requirements (Hughes 2009). From an urban geography perspective, location is a force that is independent of sustainable development. It is related to where towns and cities develop and proximity to market. Cities are systems of markets “and a fundamental assumption is that locations with good accessibility are more attractive and have a higher value than peripheral locations” (Maguire, Batty et al. 2005). The most efficient place to locate a business is at the central core of a city, known as the central business district (CBD) according to Christaller's central place theory (Balchin et al. 1995) and they need to be above a certain minimum size in order to provide both services and the demand for them (Hughes 2009). According to Zoellick (2009) the requirement for optimum sustainable development of cities is “lumpiness” which is focused

development of urban centres and compact cities. Dixon (2009) illustrates that end-users in the office market sector rank location of the proposed office building as one of the most important considerations when making their final decision to move or change office space. Proximity to public transport is rated as being a significant factor in selection of office location for occupiers.

The link between population density and types of travel patterns (for instance: mode, distance and travel time) has been demonstrated through a substantial body of research, for example The Swindon Model (Steadman, Holtier et al. 1998). The report produced by ECOTEC (1993) has supported the findings of Newman and Kenworthy (1989; 1999) and Cervero (1996) in their world survey on energy use in cities to demonstrate a clear inverse correlation between urban density and distance travelled in cars. The findings from this research show that low density, more dispersed patterns of development are less efficient from an emissions perspective than more concentrated centralised patterns of growth. This would indicate a consensus for urban compaction in contributing to make cities more sustainable.

The area at the focus of this paper is the Greater Dublin Area (GDA). The more dispersed low dense type of urban form that Dublin characterises has been identified by Carty (2010; Carty and Ahern 2011) as a challenge to achieve any major changes. The research carried out by Carty and Ahern (2010, 2011) demonstrates that the layout of our medium sized city contributes significantly to this transport related energy use. Their view is that the augmented levels of carbon emissions are difficult to control without adopting a different strategy for future development within the GDA. Their analysis took the CSO POWCAR dataset which particularly looks at the place of work patterns of people and combined it with the carbon emissions generated by various modes of transport used in the Greater Dublin Area. The outcome of the Carty Ahern (2011, 2010) papers are that the future transport energy consumption (TEC) can be reduced by encouraging more high density mixed use developments closer to strong urban centres and good public transport links. This approach would lead to reduced transport related CO₂ emissions.

The use of a model to investigate the outcome of differing circumstances and situations in a controlled way in order to be able to make fact based or scientific decisions has been well documented (Steadman 1991; Brown, De la Barra et al. 1998; Steadman, Holtier et al. 1998). This is very appropriate in the area of environmental decision making as it is quantitative and scientific. Wyatt (2011), Banister (2008) and Carty (2011) have assembled data and developed models to illustrate the TEC in both a high density compact city and a more dispersed type urban form. The following are two examples of appropriate models for the methodology in this paper:-

(a) A transport carbon dioxide emissions vulnerability index for the Greater Dublin Area (Carty 2010; Carty and Ahern 2011).

This model was created to spatially represent the regional differences in commuting distances and modal shares in terms of transport carbon emissions. In illustrating the TEC they used GIS to show the various CO₂ emissions per mode and combined this with the CSO POWCAR dataset for the GDA.

(b) Business parks and town centre workplaces in England: a comparative analysis of commuting-related energy consumption Model (Wyatt 2011).

This Model examined the transport related CO₂ emissions associated with workplace locations in comparison to town and city centre locations. It used 2001 Census Special Workplace Statistics which allowed the distance travelled and mode of travel to be calculated for a sample of workplace locations.

In order to assess patterns of energy use it is valuable to combine the results of a numerical model with the spatial analysis and visualisation capabilities of a geographical information system (GIS). The advantage of GIS is the ability to be able to communicate to a broad range of experts and non-experts in appealing and comprehensible visual formats (Maguire, Batty et al. 2005). Flowing from the literature on the models, mentioned above (Wyatt 2011 and Carty Aherne 2011) it was evident that the use of GIS in the development of the models has taken advantage of the capabilities of this type of spatial analysis and it served as a support to the decision making function by being able to layer, analyse and manipulate various types of data and information. Urban land use and transportation models are very appropriate candidates for this type of tool in that the data being used to give the outcome is both complex and computationally intensive.

Within general energy labelling rating systems, such as BREEAM (2011), there is already a category to rank locational connectivity as part of the scoring system. Hence according to Wyatt (2011) the location of the premises could also be scored based on its ability to minimise TEC because mandatory energy certification of real estate in England takes the form of Energy Performance Certificates (EPCs) and at the moment takes no account of commuting – related energy consumption. It would appear from the literature review that there is a gap in the research for a more fine-grained model to be created for the GDA. This model could combine both transport and carbon emissions in the context of the GDA. The outcome of the model would aim to provide a CO₂ reading for the various locations in the GDA whereby a ranking of these sites in terms of sustainability would be a very useful outcome.

3.0 Methodology

The key objective of this paper is to assign a transport-related carbon (CO₂) emissions weighting to work place destinations in the Greater Dublin Area (GDA) based on current commuting patterns in the GDA. A general map of the GDA study area in the context of Ireland is presented in figure (3) below.

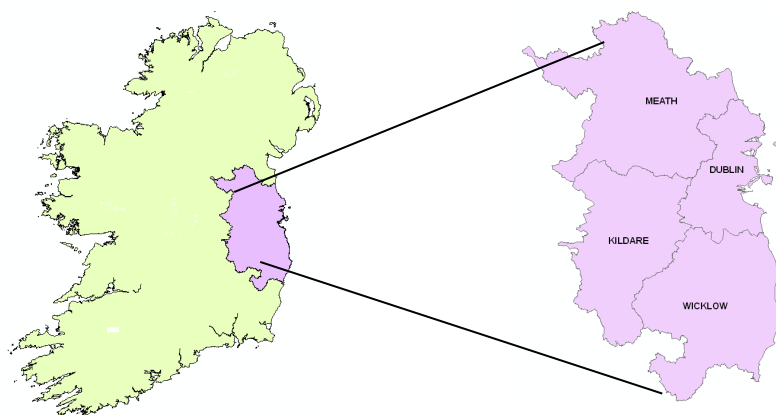


Fig. 2. The GDA study area in the context of map of Ireland (Source: Authors)

The CO₂ weighting was computed by creating a model which included the distance from home to work, the mode of transport taken to work, and the CO₂ emissions factor for this mode. Within the model the calculation was repeated for all journeys with a final destination in the GDA. The destinations were aggregated to a 250 metre by 250 metre grid superimposed on a map of the GDA. The model output was then entered into a geographical information system (GIS) to facilitate visualisation and analysis.

The CSO created a dataset that issued with the 2006 census known as the Place of Work – Census of Anonymised Records (POWCAR) which records persons who make commuting trips to work. The POWCAR dataset is available at the level of 250 metre grid squares. This presents an opportunity to carry out a more fine grained analysis of the GDA study area which is the subject of this paper. In their paper Carty & Aherne (2011) calculate the CO₂ emissions for the dominant modes of transport in the GDA. These figures are provided in terms of kilogrammes (kg) of CO₂ per person per kilometre (km), for bus, rail, car, car passenger, LUAS (both red & green lines), DART and motorbike. Pedestrians and cyclists are assigned zero emissions. The figure for lorry transport was obtained from a UK source (Davies 2003).

There are 569,565 journeys recorded in the POWCAR dataset, with people travelling to work in 11,811 of the 111,797 grid squares in the GDA. The model was required to calculate the CO₂ generated for all of the journeys to each destination grid square. This required the distance in kilometres (km) to be multiplied by the CO₂ per km associated with the mode of transport taken for each journey, and the sum of all CO₂ generated by journeys to a given destination grid square to be calculated. The CO₂ generated per employee was then calculated by dividing this figure by the number of journeys to that grid square. This determined the carbon emissions per person at 250 metre grid square destination level and the next step was to map these numerical results. The use of GIS for the analysis of this type of spatial and numerical data was very beneficial and enhanced the outputs of the model.

The GIS software (ArcGIS®) facilitated the display of multiple outcomes from the newly calculated dataset which included the following:-

1. The working population for each destination 250 metre grid square.
2. The CO₂ emissions per person travelling to each 250 metre grid square.
3. The mode split per person travelling to each grid destination.
4. The total emissions per grid destination.

A benefit of using GIS technology in this study is the ability to portray vast amounts of statistical information in a visual and comprehensible manner. Often it is possible to discern trends, patterns and correlations in the data when displayed graphically that were not obvious in the tabular data. The advantages of utilising data at the 250m grid square level compared to data at electoral district (ED) level is clearly demonstrated resulting in a finer grained analysis and closer correspondence to the distribution of the population on the ground. See the following: figure (3) - Population at ED level in GDA; figure (4) - Population at 250 m grid square level in GDA and figure (5) - population at 250 m grid square level for origin and destination.

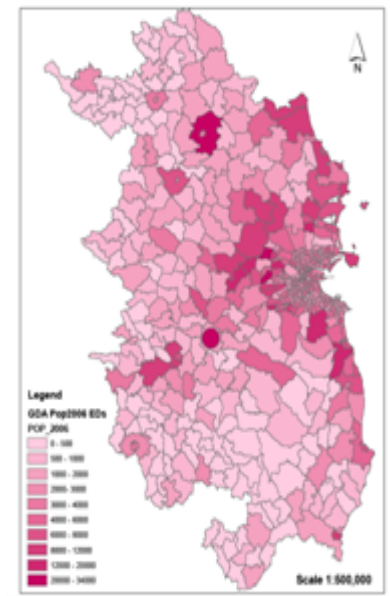


Fig.3. Population at Electoral District (ED) level in GDA (source: authors)



Fig. 4. Population at 250m grid square level in GDA (source: authors)

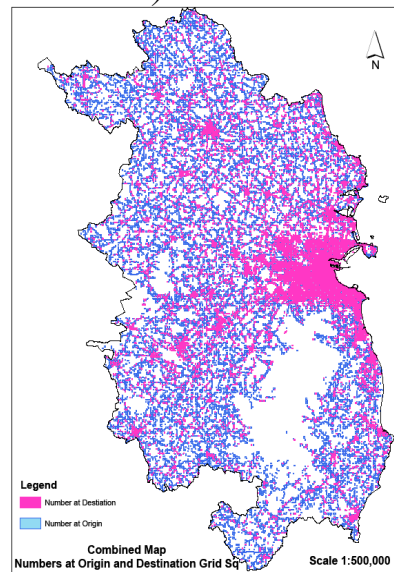


Fig. 5. Population at 250m grid square level for origin and destination in GDA (source: authors)

4.0 Results

The key finding from this research is that the carbon dioxide (CO₂) emissions per employee in city centre locations is up to 4 times lower than that associated with travel to destinations close to or outside the M50 (the outer ring road around Dublin City Centre). This is reinforced by the survey data from three test sites and correlates with the results from the model created.

The results presented in this research are best displayed as a series of maps and a summary table of carbon (CO₂) emissions generated to the three test sites. The maps

have been created using the GIS software and clearly represent the main findings. Data presented in the table further verify the maps, providing a numerical insight.

The model data permits a ranking of the destinations in terms of transport-based CO₂ emissions, analogous to the labelling of household electrical goods for energy consumption. The exact numbers for the carbon emissions to the three locations surveyed are given in Table 1. below:-

Table 1: Overall CO₂ emission results for the model at three sample test sites

<i>Test Sites</i>	<i>CO₂ Emissions (kg p.pers.)</i>	<i>Destination Population</i>
<i>City Centre</i>	1.09	4589
<i>M50 Suburban</i>	5.05	393
<i>Outer Suburb</i>	5.97	86

4.1 Map results

The maps illustrated below (Figures 6. and 7.) illustrate an aerial view of the city centre test site with the grid square circled in yellow. The data for this grid square is taken from the POWCAR dataset and matched up with the relevant CO₂ output from the model for this test site grid square.



Fig. 6. Population at Destination 250 m grid square – 4589 persons



Fig. 7. CO₂ Emissions City centre - 1.09 kg CO₂ per person



Fig. 8. Population at M50 destination – average 393 persons



Fig. 9. CO₂ Emissions at M50 Destination grid square- average 5.05 kg CO₂ per person

The population travelling to the test site in fig. 8., above, is split over two grid square destinations because the office building falls within two grid squares. Hence the numbers presented are an average of the two grid square destination populations circled in yellow – 354 persons and 431 persons.

Hence the CO₂ emissions in fig. 9 are representative of the average readings taken from the two grid squares circled where a comparison was made between the modes of transport travelling to both grid squares.

The next two illustrations (figures: 10 and 11) represent the outer urban sites. They are showing readings that are very high representing the lack of suitable options for travel journeys to an outer suburban destination. The reading for the carbon emissions is split across two grid squares - hence the two squares are encircled.



Fig. 10. Population at Naas – Outer Urban destination – 86 persons (average)



Fig. 11. CO₂ emissions at outer suburban destination – 5.97 kg CO₂ per person (average)

The key finding is shown in the results of the three test site locations. The city centre is by far the most sustainable location of all three sites. It generates the lowest carbon emissions per person to travel to it. These numbers were taken directly from the model and as indicated some of the data required further investigation as the test sites fell across two grid squares. In each of the two cases where this occurred, it was necessary to take the data for both grid squares and average out the numbers to portray a fair reading from the model.

The overall result, whereby the city centre is four times lower than the suburbs, concurs with the expected outcome for such locations.

5.0 Conclusion

The overall aim and objective of this paper was to evaluate the link between carbon emissions, transport and location in order to devise a tool to assist planners. Through the literature review and the model results it has been demonstrated that there is a clear link between these three factors. Hence it is important to consider environmental performance beyond the operation of the building itself. This may lead to a re-evaluation of the role of out-of-town work place destinations with respect to the higher CO₂ emissions recorded as a result of car generated journeys to these locations.

This paper set out to provide a tool to assist in evidence based decision making in the context of improving the environmental component of the decision whether in a development or planning context. The research has succeeded in this purpose because it is both scientific and quantitative but lends itself to a generally accessible qualitative interpretation. A logical next step would be to run the procedure with the 2011 census data and to extend the model to include data for the entire country.

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Design of the Contemporary Saudi-Arabian House

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Abstract

The mid-1950s marked the introduction of the grid layout street pattern and the detached villa house type made of reinforced concrete with big windows and balconies. Today, this is still the prevalent style in Saudi Arabia and the central province in particular. While the traditional courtyard house created its own privacy and microclimate, this contemporary type is a solid building with narrow setbacks. It has become apparent that the villa style creates fundamental problems for Saudi families, especially in terms of privacy and the negative implications of air-conditioning for the climate. This paper will first demonstrate the nature of both the courtyard and villa house types before attempting to develop some guidance for house design that could satisfy 21st century aspirations yet still respect traditional solutions.

Keywords

Saudi Arabia, Design guidance, courtyard and villa houses.

Introduction

Saudi Arabia is characterised by a diversity of climatic, social, topographical, environmental and cultural traits that are embodied in diverse architectural styles and urban patterns. Each province distinguishes itself through the use of local building materials, which have confirmed over time their effectiveness and efficiency in dealing with the climate, as well as social and Islamic cultural requirements such as maintaining the privacy of residents and neighbours, not to mention their suitability from an economic perspective (Talib, 1984). Turkustani (2008) divided the Kingdom of Saudi Arabia into four principal geographic provinces: the central province, the western province, the southern province, and the eastern province (Fig. 1).



Fig.1. Saudi Arabia – the four Provinces

The central province represents the very centre of the country in terms of geography, and includes large regions such as Ar-Riyadh, Qasim and Hail, wherein urban settlements first took shape on the banks of the valleys, before emerging in the form of agricultural oases. The prevailing architectural style is dictated by the dry desert climate, and is thus limited to the use of local techniques and building materials such as stone and mud. Eben-Saleh (2001, 1998) notes that the desert climate was clearly evident in the urban fabric characterised by its compact pattern and narrow winding alley-ways, used in order to minimize the effects of dusty winds and the impact of the hot sun (Fig. 2).

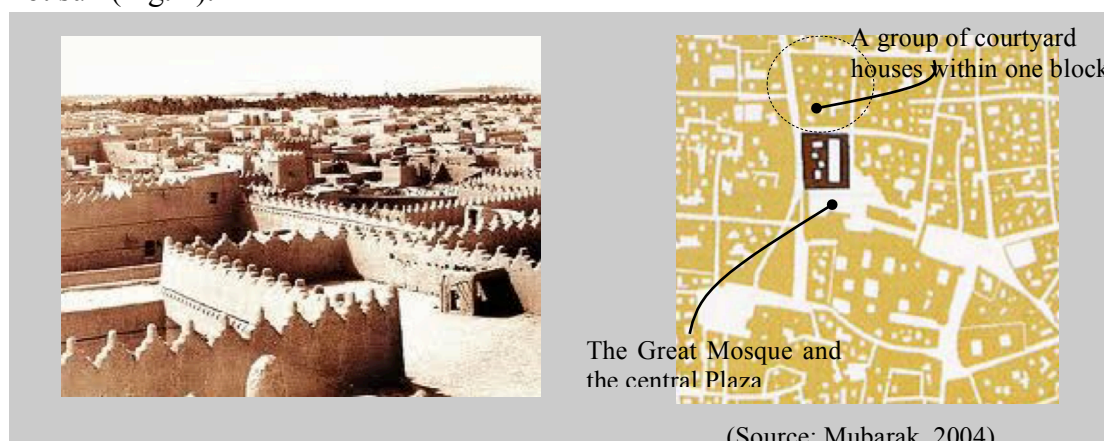


Fig. 2. Compacted and introverted urban pattern, Riyadh- 1930

The western province, which includes large cities such as Mecca, Medina, Jeddah, and Taif, has been influenced by external and migratory cultures during the season of 'Hajj' – An annual season when Muslims come to Mecca to perform a worship, in addition to the presence of the seaport city of Jeddah, which made it into an area of commercial relations with countries bordering the Red Sea. This in turn has played a key role in bringing in different construction methods and architectural solutions from around the Islamic world. The urban fabric in the western province is similar to that in the central province, i.e. compacted with narrow winding alley-ways. As to the architectural traits, King (1998) underlines the height of buildings which amounted to three and four storeys, in addition to the large number and size of windows covered with 'Mashrabiya' or 'Roshan', wooden blinds made of wood lattice (Fig. 3), imported from India and the coast of East Africa. These serve to protect the privacy of residents and neighbours, as well as allowing air passage to the internal spaces and reducing sunlight brightness during the day (Eben-Saleh, 2001; Turkustani, 2008).

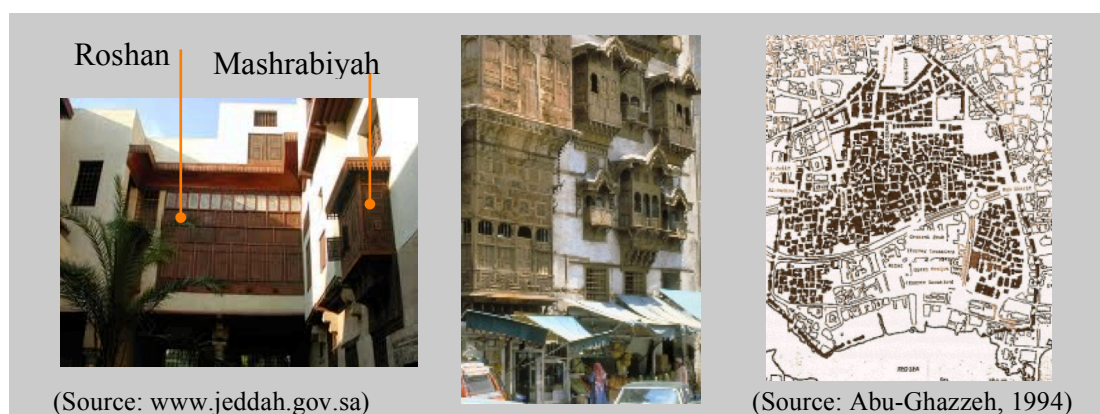


Fig. 3. Western Province: Mashrabiya and Roshan, compacted urban fabric.

In terms of building materials, there is the natural stone in two types: limestone coral, which is used in coastal cities such as Jeddah and Yanbu; and mountain stone, which is used in Mecca and Taif (Turkustani, 2008).

The southern province is made up of small farming communities, spread out over different parts of the province, on mountain tops and on the west coast. This province is characterized by climatic and topographic diversity, which in turn has created its distinctive architectural styles, based on different building materials and construction methods. For example, the area located to the east of the Al-Sarawat Mountains ('Najran') is characterized by a desert climate (hot and dry in summer, with mild temperatures and lack of rain in winter) and compact urban patterns, built of mud bricks. Meanwhile, mountainous areas facing the Red Sea, such as the city of 'Abha', are characterized by moderate temperatures in summer and a higher rate of rainfall and cold weather in winter; the urban pattern has emerged in the form of small groups that are separated by farms, while stone is added to mud as building materials. The coastal areas are characterized mainly by very hot climate with high humidity in summer and mild temperatures in winter; while tree trunks, branches and dry grass with twisted ropes are used for constructing residential huts (Fig. 4). The eastern province of Saudi Arabia is located on the east coast mainly as a group of settlements such as 'Ad-Dammam' and 'Al-Khobar'. It is characterized by hot and humid climate in summer, compact urban fabric with two-floor building heights, and houses built of mud and coral stones (Fig. 5).

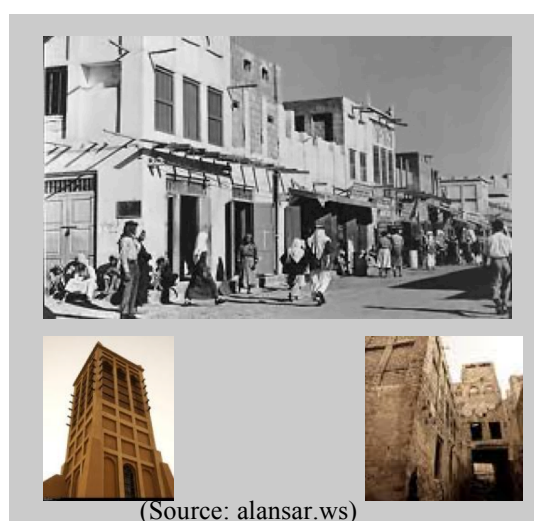
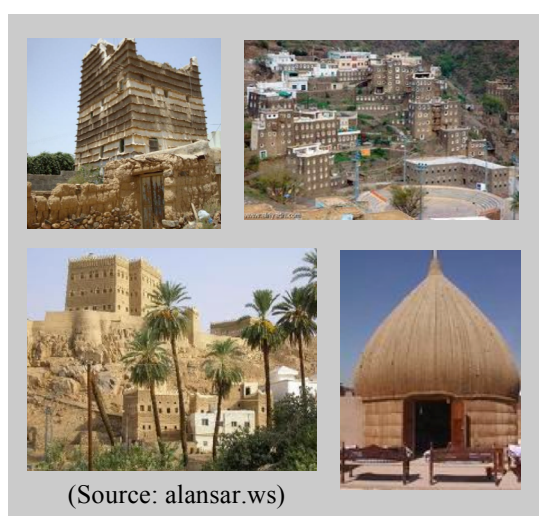


Fig. 4. Southern Province architectural style Fig. 5. Eastern Province architectural style

Due to variations in climatic, topographic and cultural characteristics among the different provinces of Saudi Arabia, this study would only apply to a province and even then specifically to a city. The central province, which has a hot and arid climate, has been selected. It comprises three regions: Ar-Riyadh, Al-Qasim and Hail. As states by Eben-Saleh (2001), that all three regions have the same climatic and cultural characteristics, Ar-Riyadh region has been selected as the most populated region. Each region comprises several cities; one city sample –Riyadh city - will be used to represent this region (Fig. 6).

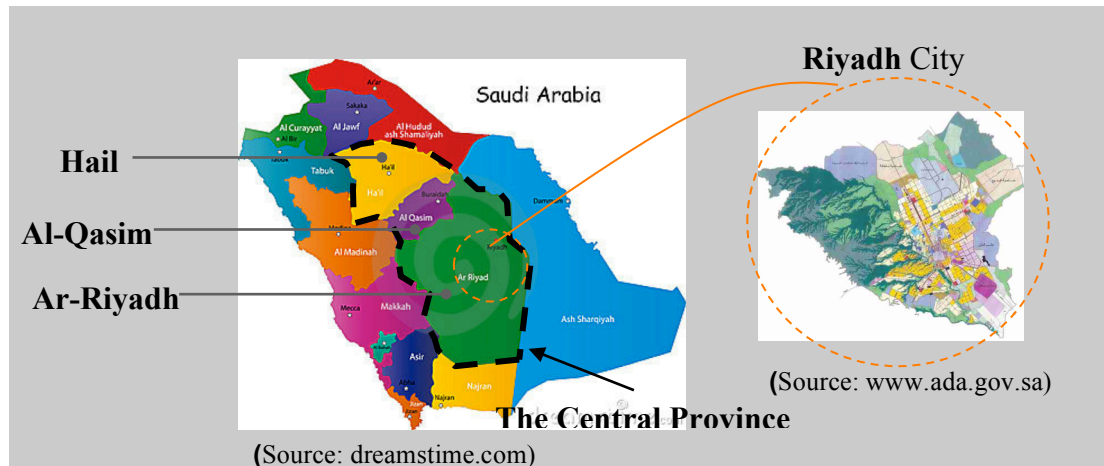


Fig. 6. Saudi Arabia - The Central Province and Riyadh City

Problem statement and study aim

The mid-1950s marked the first period of Saudi Arabia's rapid economic growth as a result of the discovery of oil (Eben-Saleh, 1998). Oil dramatically increased the wealth and prosperity of the general population, resulting in a new lifestyle (Bahammam, 1998). This change also forced the state to start providing new infrastructures and roads (Al-Ibrahim, 1990) through a policy that advocated demolishing and removing parts of the old neighbourhoods and courtyard houses (Eben-Saleh, 1998). This period also witnessed the introduction of the grid street pattern and the detached house type or villa style (Fig. 7) by the Arabian-American Oil Company (ARAMCO) into the eastern province, using new building materials such as reinforced concrete and cement bricks (Mubarak, 2004). The new style includes big windows and balconies (Al-Said, 2003) and an emphasis on setbacks from all sides of the building (minimum of two meters) in order to provide ventilation and natural light to the internal spaces (Al-Said, 2003).



Fig. 7. Grid pattern and villa style

Subsequently, the state adopted this modern style of grid pattern and villa style for the development of all cities in the kingdom (Al-Hathloul, 1981). With the introduction of imported modern building materials and construction methods, residents began

replacing the weakly mud brick with the more solid cement block, which now forms the style of houses in Saudi Arabia in general and the central province in particular (Mubarak, 2004). Saudi residents want new technology but they also wish to preserve their identity and traditions: *"People should not have altered their lives to fit their homes; rather the home should meet their needs and fulfil their desires"* (Eben-Saleh, 1998: 585).

This has now become the contemporary house style. While traditionally the building included a private courtyard, this contemporary style is a building surrounded by space – setback - and exposed to the hot-dry climate (Al-Ibrahim, 1990). This approach creates fundamental problems for Saudi families, especially in terms of privacy and the negative implications for the climate of air-conditioning. Thus, this study aims to demonstrate the nature of both house types, and to develop some guidance for house design that will satisfy 21st century aspirations, yet still respect traditional solutions.

The Influence of Islamic Culture on House Form

The Islamic culture has had a profound impact on all aspects of Muslim life, including the built environment which is shaped to meet the requirements of the Islamic faith (Eben-Saleh, 1996). Spahic (2010) contends that Islamic beliefs are at the heart of how Muslims build and use their built environment in general and their houses in particular. Ibrahim (2004) points out that the Islamic content represents the stable element of the Islamic perspective on architecture, which does not change according to location or time and therefore acquires a global character, while the figure is variable and has a local character. For instance, in the Qur'an (2:189), Allah (God) emphasizes people's need for privacy as highlighted in the provision of two entrances to the house, one for male-guests, and another for family members and female-guests (Nawfal, 2011).

Traditional House - Courtyard

The courtyard house is a universal style that dates back to the Greco-Roman tradition, which Muslims adopted as it is adaptable to their religious and social needs such as privacy, as well as providing a prime solution to the climatic conditions (El-Shorbagy, 2010). The style accompanied human civilization since time immemorial even to this day, and has taken several forms and names depending on the era such as Atrium in Byzantine architecture, Copositer in Gothic architecture (Eid and Yousef, 2000), 'Hosh', 'Yard', and 'Patio' (Fig. 8) among several Arabic towns such as Marrakesh and Tunis (Ragette, 2003).

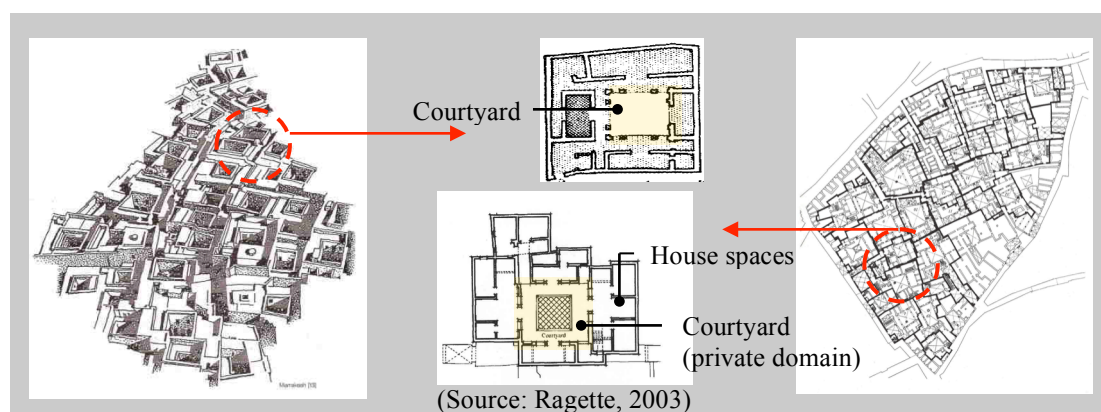


Fig. 8. The courtyard pattern in Marrakesh and Tunis, 1968.

The suitability of the courtyard house to warm climates may explain why it continues to be used in warm parts of the world despite the different social, cultural and religious sensitivities (Eid and Yousef, 2000). According to Turkustani (2008) and Al-Saleh (2008), the traditional urban fabric is characterized by compacted and interconnected houses that are pedestrian-oriented, narrow and winding alleys, and house interconnection that reduces the wall's exposure to the sun and hot wind. Moustapha et al. (1985) point out that courtyard houses are built close to the ground to avoid exposure to the sun, and most buildings are grouped together to provide shade and create conditions of a cooler microclimate. Eben-Saleh (2002, 1998) notes that the traditional spatial fabric has protected its residents through control of access, hierarchical territorial order, cul-de-sac system, and a courtyard dwelling style with small and limited openings (Fig. 9).

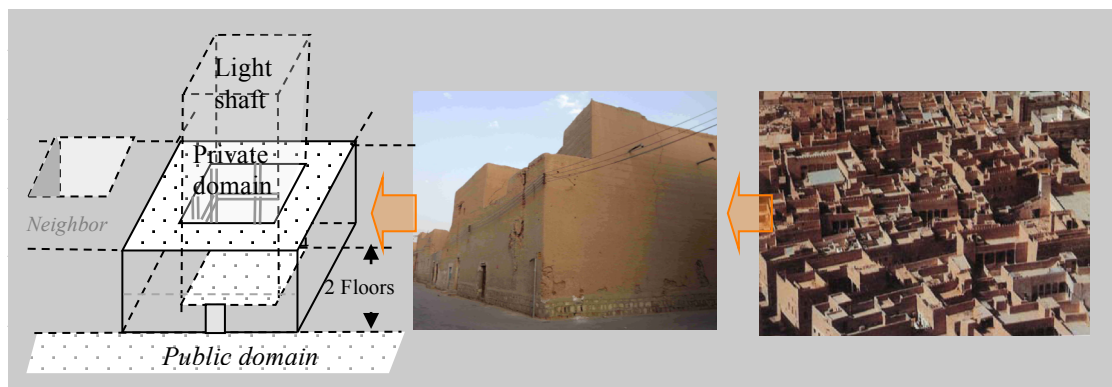


Fig. 9. Courtyard house – environment and concept

House Form

Riyadh's traditional house is built with thick walls of mud around one or more courtyards, and has large openings toward the courtyard to cater for household privacy needs. Courtyard houses are faced away from the street, acquire their air and light from the courtyard, which acts as a temperature regulator, providing shade in summer and retaining the cool air at night (Eben-Saleh, 1998). In terms of spaces, Bahammam (1998) divides the traditional house into two main sections: the guest and the family sections. The family section consists of the parents' bedroom and a set of living spaces – rooms - which are used for purposes such as sleeping, eating, and family gathering (Fig. 10).

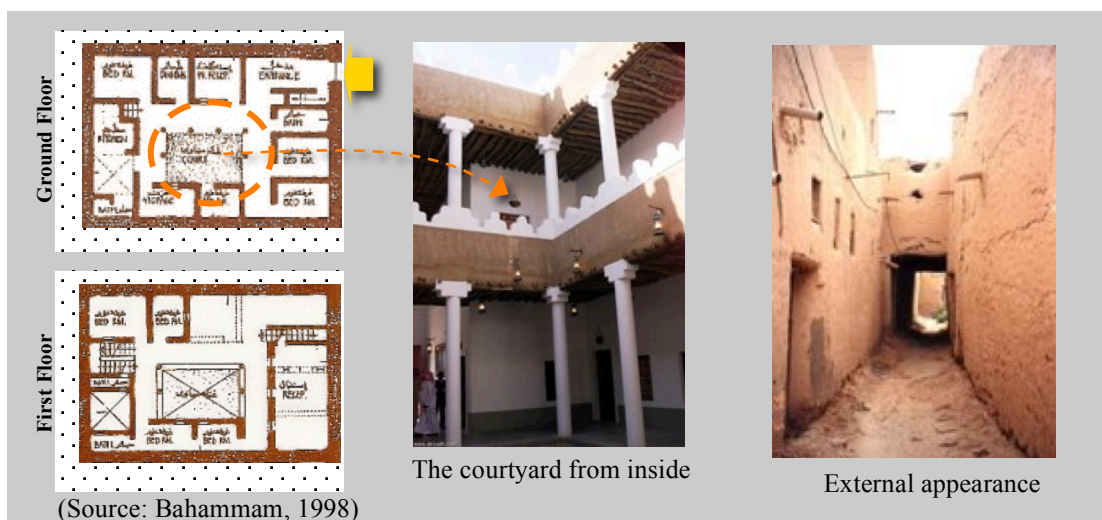


Fig.10 . Courtyard house design - focal point.

Arrangement of spaces in courtyard houses is based on the segregation of genders; thus, the male section is usually located adjacent to the entrance lobby either in the ground floor (Bahammam, 1998) or upstairs with the reception room, in which case, a staircase is included within the entrance lobby for male users (Ragette, 2003) (see Fig. 11). Intended for the purpose of privacy, the family section is always located away from the house entrance (Bahammam, 1998). The courtyard house, according to Ragette (2003), has two main entrances, one for male-guests and the other for family and female-guests; the male-guests' entrance leads directly into the guests' reception area, while the family and female-guests' entrance usually leads into the courtyard.

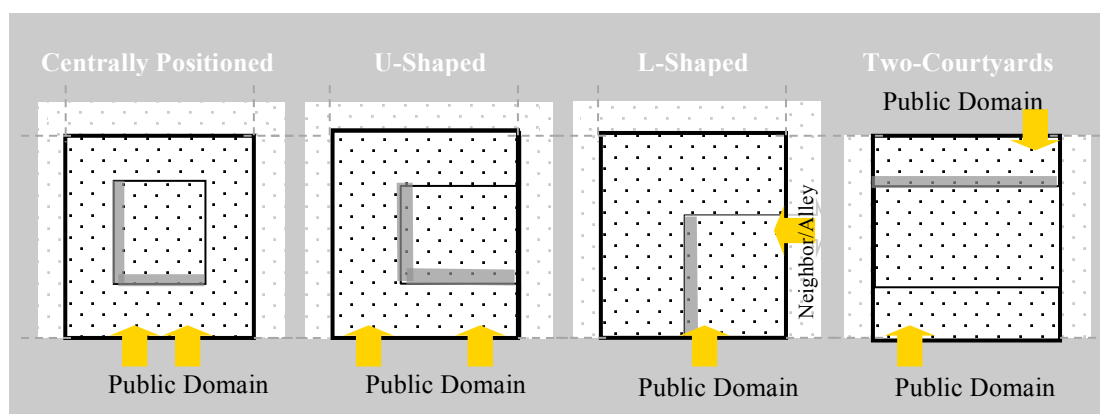


Fig. 11. Courtyard houses' – types and thresholds

Mud, stone and woods constitute the most essential building materials of courtyard houses; walls are built of solid sun-dried bricks, while the roofs are built of wooden rafters, palm or tamarix aphylla trunks which effectively mean that room size rarely exceeds 2.5 meters in length (Bahammam, 1998; Mubarak, 2007). Doors and windows are made of wood that is available locally (Turkustani, 2008). However, Eben-Saleh (2001) points out that the traditional building materials did not lend themselves to the increasing demand for houses or adaptation to modern furniture which is difficult to keep clean.

Cultural and Social Aspects

Influenced by the Islamic culture, the introverted character of the courtyard house emphasizes the privacy needs of family members (Moustapha et al., 1985). Bahammam (1998) argues that dwellings' privacy in Saudi society is clearly visible in traditional dwellings as an introverted concept. Al-Hemaidi (2001) defines the courtyard house as a private space where its inhabitants' activities take place without their privacy being violated by overlooking adjacent dwellings. On the contrary, Al-Ibrahim (1990) points out that people prefer not to have shared walls with their neighbours as it threatens their privacy, especially regarding roofs where inhabitants would sleep during the summer season. In other contexts, Eben-Saleh (1998) suggests that when the physical place – courtyard house - is properly designed to meet the requirements of both the physical and social conditions, its visual image may carry an appropriate place identity, i.e. the individual's home may be deemed as both a human place and one of identity. Furthermore, Eben-Saleh (1998) seems adamant that the creation of identity should emerge with original ideas that tie culture, climate and

lifestyles together and use those as a basis for the urban form. In terms of the sense of belonging, Al-Nowiser (1985) notes that place has strong, commonly shared meanings, as long as individuals and groups are affected by communal (social, cultural and religious) norms. Thus, courtyard houses had succeeded in meeting the cultural needs of their inhabitants, thereby incarnating the concept of inhabitants belonging to a substantial place (Moustapha et al., 1985). As a focal point, the courtyard space functions as a private open space, a place where adults may meet, and a place for social and religious activities among family members (Bahammam, 1998). The spatial elements of the physical environment in a courtyard house symbolize all the major activities taking place in it (Al-Nowiser, 1985).

Villa House

The new concept of planning - grid pattern - and detached dwelling - villa house - was introduced for the first time to the eastern province by the American Company ARAMCO, with wide and straight streets, automobile-oriented, rectangular blocks and square lots for the most part, low population and land use densities (Eben-Saleh, 1998). According to Alexander (1987), each building is responsible for the formation of the space surrounding it. So, public spaces in a city are formed by buildings and not vice versa, as is the case in contemporary cities. According to Talib (2010), the villa-house in Saudi Arabia is derived from an international style, and is not based on the real lifestyle and present needs of Saudis. Bahammam (1998) is also of the opinion that the villa-house is not built based on the immediate needs of the Saudi household, but is rather a modern building that reflects a collection of new technical requirements prepared by the municipality of the city: setback requirements from four sides, through which all openings are oriented outwards (Al-Hemaidi, 2001) (see Fig. 12); exposed to the local climate, hot-dry and sandy winds (Talib, 2010); and the constant use of air-conditioning systems as a solution (Al-Nowaiser, 1996). The existing mandatory setbacks expose most of the external and internal spaces of the house to its neighbours, with long windows facing each other, meaning that house windows cannot be opened in most cases resulting in health problems, dark interiors, as well as unused outdoor spaces (Al-Nowaiser, 1996).

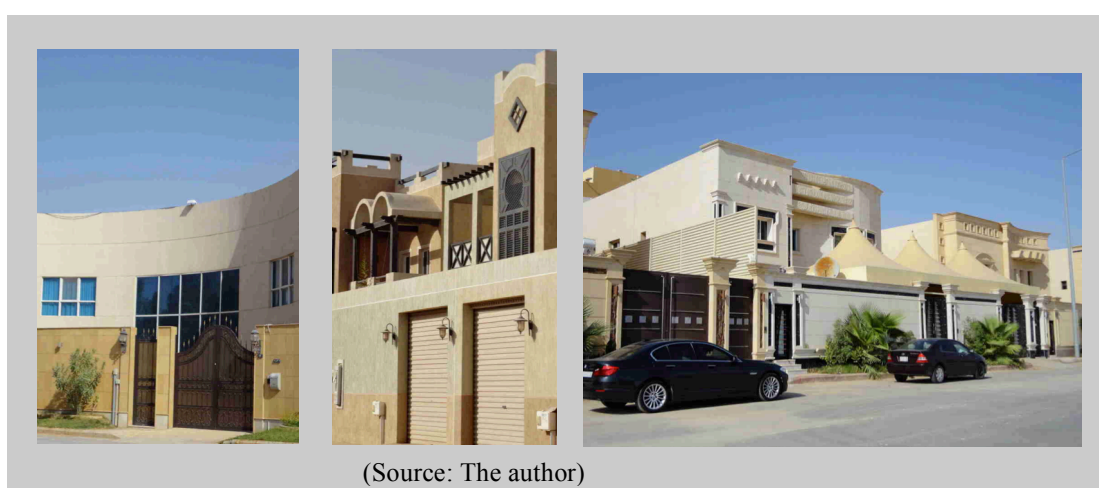


Fig. 12. Villa House – outward concept

Based on those technical requirements, prepared by the Ar-Riyadh Municipality (2007), there are three types of villa-houses identified as a final product of the

setbacks regulations: detached-house, one-side attached-house, and two-side attached-house, with the last two being applicable only in the case of family and relatives (Fig. 13).

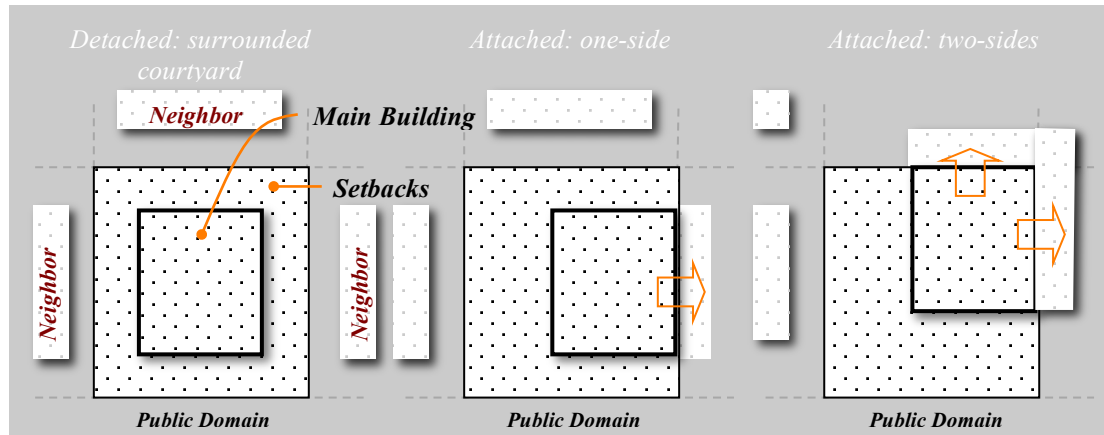


Fig. 13. Villa House, the three types

House Form

The villa-house now constitutes most single-family dwellings in Riyadh, with its extroverted concept—being clearly hostile to that of the courtyard-house (Al-Hemaidi, 2001). A typical villa-house consists of two or three guest spaces 'majlis', male and female, one or two guest dining spaces, one or two living spaces 'saalh', three or more bedrooms, one or two kitchens, four or more bathrooms, plus several storage spaces (Bahammam, 1998). The average size of a villa-house is 442 square meters, which is more than twice the size of a courtyard-house (Bahammam, 2003). The entire lot frontages are reserved for vehicular entries and parking (Al-Nowaiser, 1996). In terms of the arrangement of spaces, as stated by Bahammam (1998), it does not differ from that of the courtyard-house. It consists of two main sections: family and male-guest sections, where the family section is restricted to the use of family members, female guests and maharms – male relatives who cannot marry house females - and is thus located away from the main entrance. The male-guest section consists of a reception room, bathroom, and dining room; all bedrooms are located on the first floor; the maid's room is located on the roof while the chauffeur's room is located in the front yard of the house. In terms of villa-house thresholds, as illustrated by Bahammam (1998), there are two levels of thresholds: the plot and the building. The plot has three gates: male-guest, family and female-guest, and car's gate; while the building has two entrances: male-guest, family and female-guest (Fig. 14).

In terms of building materials, the villa-house is built of cement bricks and reinforced concrete (Al-Hathloul, 1981) and adorned with glass and marble tiles (Mubarak, 2007). Bahammam (1998) points out that the new building materials and construction technology allow for building longer roof spans and creating bigger rooms compared to the smaller ones in a courtyard-house.

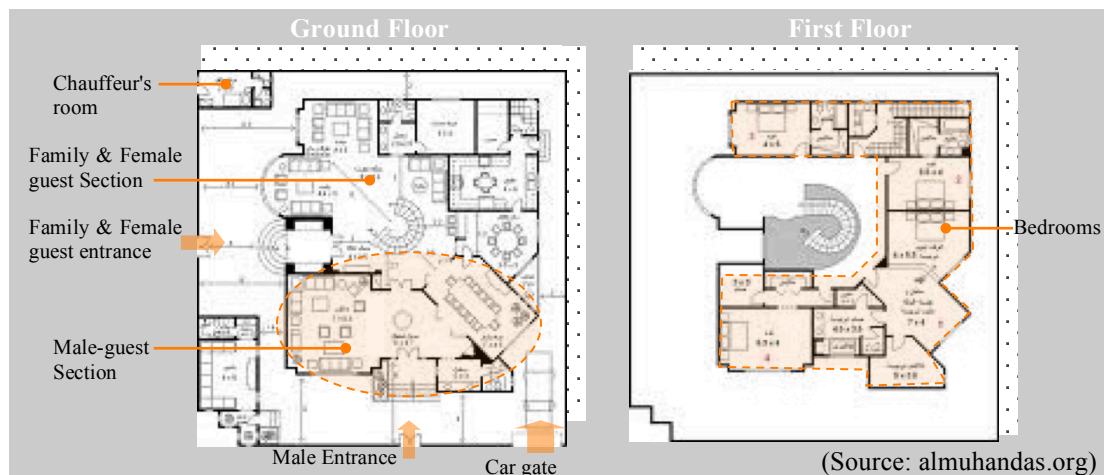


Fig. 14. Villa-House: spaces, arrangement and thresholds

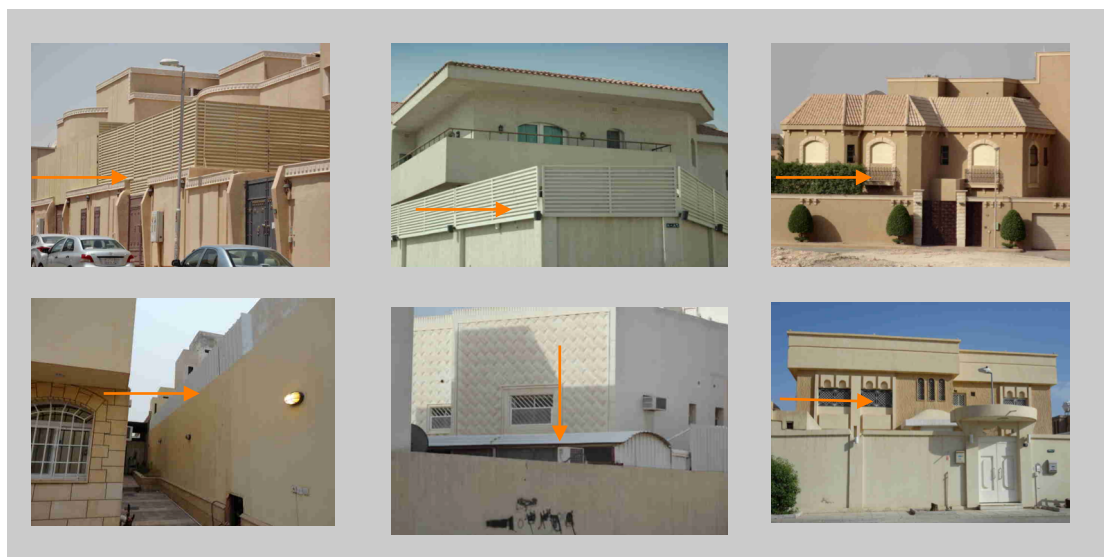


Fig. 15. Negative impacts of the technical requirements as the setbacks

The current grid patterned residential subdivision, as pointed out by Al-Nowaiser (2001), has led to increase in crime rates among Saudi settlements, which in turn has prompted some residents to seek protective treatments such as fortifying their houses using fencing walls of 3-6 meters high and iron-grilled windows, and living in relatives' blocks or gated residential neighbourhoods. In another context, Al-Nowaiser (1996) warns that the mandatory setbacks on all sides of the house are incompatible with privacy needs. Further, he asserts that even the bedrooms – say in two adjacent houses - have auditory and visual access between them, forcing residents to use a variety of solutions to protect their privacy, such as raising boundary walls as high as six meters in addition to blocking off windows and balconies (Fig.15), or grouping families and relatives within a common compound. Eben-Saleh (1998) indicates that balconies and large windows, albeit designed to add an attractive look, have an adverse effect on household privacy as they expose the house to unwanted intrusion from curious onlookers. The large size of plots and high walls around houses as well as setback spaces may have adversely affected the sense of community (Al-Nowiser, 1996). Eben-Saleh (1998:579) characterizes the new built environments in Riyadh as '*alienating, anonymous, and hostile*', lacking urban and architectural identity. Al-

Hemaidi (2001) warns that the new urban developments – villa-houses districts – are being introduced to the city of Riyadh by foreign experts. These may not be compatible with the local environment, let alone the residents' Islamic cultural background. As to the sense of belonging, villa-house districts are influenced mostly by market forces and technology, which result in phenomena such as individualism and materialism; i.e. residents are less attached to their environment, hence a feeble sense of belonging (Al-Nowiser, 1985).

Requirements for Contemporary House Design Guidance

As discussed above, the traditional dwelling (courtyard house) has the ability to meet the climatic and cultural needs of its residents, even though as it stands, it does not seem to answer the aspirations of the twenty-first century. In contrast, the villa-house seems to respond to those aspirations, even though it does not seem to meet the climatic and cultural needs of its residents. The villa-house is not expected to merely copy from traditional practice, but to develop strategies based on a clear understanding of methods employed by traditional people which include: compact pattern of development; hierarchy of open spaces (public, semi-public, semi-private, and private); and the local design and building materials, taking into consideration changes in lifestyle and challenges of natural resources. Furthermore, to take advantage of the courtyard concept as a private space that serves to accommodate family activities, setbacks regulations ought to be reconsidered; i.e. the courtyard concept may not have the capacity to adapt to twenty-first century aspirations. Nevertheless, we can still investigate the benefits from cancelling one or more of the setbacks.

Methodology for the Data Collection

The next phase of the research will be to collect primary data on residents' satisfaction or dissatisfaction with both house types. To gather information - facts and opinions - about a fairly large number of households living in courtyard and villa houses, 'survey' seems to be a very convenient approach (Denscombe, 2010). As the purpose is to get a representative sample, the size of the sample will tend to be relatively large (Denscombe, 2010). Using a sample size calculator with a confidence level of 95% and confidence interval of (5), 800 questionnaires will be distributed door-to-door: 400 for courtyard households, and the other 400 for villa households. A simple random sampling method will be used to select the study sample.

Furthermore, to obtain in-depth and direct data regarding the user's level of satisfaction or dissatisfaction with their residence environments and any related experiences and design problems, face-to-face semi-structured interviews, will be conducted with a number of users of the selected houses. Conducting interviews with households is considered to be an auxiliary method (Kvale, 1996), whose results should complement the results of the survey questionnaires, thereby giving the findings more strength and validity. Moreover, to understand the house design and how it fit with residents' needs, an analysis of architectural drawings, floor plans, and elevations will be made of both courtyard and villa houses.

Conclusion

This study of houses in Saudi Arabia has shown that they vary in the different provinces. It has therefore been decided to focus on the Central Province and Riyadh City in particular. The literature review demonstrated that the discovery of oil has made a significant change in people's aspirations. The traditional courtyard houses satisfy the needs for natural cooling of the environment. These houses are also very private and it is often difficult to tell where one house ends and the next begins. However, since the middle of the 20th Century, an American influence has been apparent; and houses have been developed in a more ostentatious style. In the past, religious teachings meant that the people had little ego. Yet, with affluence came the need for status and this has been expressed in house design. The new villas have also enabled the technological advances of the 20th and 21st Centuries to be incorporated. Provision for motor cars and electrical goods has become part of the design; and air conditioning used to control the environment. Unfortunately, the heat pumped outside from this air conditioning is also raising external temperatures and correspondingly increasing design temperatures for future provision. Nevertheless, the biggest change has probably been from the inward facing courtyard houses to the outward facing villas; and this has had huge impacts on the privacy of residents. In response, home owners are erecting great fences and screens, and they are blocking out light from windows – in an attempt to re-assert their privacy. This is clearly an unsatisfactory situation. The objective of this research project is therefore to generate some house design guidance that respects the traditional attributes of the courtyard houses while meeting 21st Century aspirations. The next phase of the research will be to collect primary data on residents' satisfaction and dissatisfaction with the various aspects of their houses, together with an analysis of floor plans and external appearance. These data will provide invaluable inputs to the proposed design guidance, which will be made available to the city authorities.

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Delivering Successful Regeneration of Historic Assets in Regeneration Areas

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Abstract

The regeneration of heritage assets is seen as a key urban regeneration initiative in the United Kingdom by central government who have expressed a commitment to promoting these projects due to their potential to regenerate derelict sites and stimulate economic activity in an immediate locality. However a plateau or fall in public and private sector investment and the abolition of quasi public sector Regional Development Agency organisations who were significant investors in heritage, coupled with major changes in planning policy is affecting the current process of delivery of these projects. The rationale to complete this research project originates from the researcher being employed in a development management role by a private practice regeneration company.. The research project when completed will add to the existing body of research and provide a unique contribution by delivering a detailed description of the private sector development and investment community's perspective and role in these regeneration projects. The ontological and epistemological positioning of the research project is the adoption of a pragmatic ontological stance associated with mixed-methods research. The research paper presented at the conference will provide a justification for selection of this topic for doctoral study and will include a presentation of the proposed research strategy, update on progress to date and present a roadmap outlining the steps required to complete the doctoral research project.

Keywords

Heritage Assets, Mixed Methods, Pragmatism, Qualitative research, Successful Regeneration

The Proposed Research Problem

The research subject area is described above. The aim of the research project is to investigate the reasons why some projects progress to successful completion whilst others fail and is guided by the following objectives:

1. To investigate the current process of using heritage assets in the urban regeneration process, making an analysis of its strengths and weaknesses.
2. Identify key factors that affect the process and their relative impact on the success and failure of delivery.
3. To evaluate the economic, physical, social and environmental value of these completed regeneration projects.

4. Explore these projects from a private sector development and investment communities' perspective, understanding their role in delivery, identifying barriers to, and incentives for involvement in heritage regeneration.
5. Evaluate the role of the public sector in the delivery of heritage regeneration projects.
6. To evaluate the impact of recently implemented changes in national planning policy on these projects.
7. Generate substantive theory as to why some projects proceed to successful completion whilst others fail.
8. To produce practical guidance, via the creation of a weighted idealised process matrix, outlining key enabling factors required to deliver successful regeneration of historic assets in regeneration areas.

In summary the intended focus is on gaining an understanding of why some projects are successful whilst others fail and identifying key drivers that contribute to the successful delivery or failure to complete. Findings of the research project will be presented in a weighted idealised process matrix to add practical value to the research project by outlining best practice and creating a roadmap for use by current practitioner's.

Research Rationale

The desire to complete this research project originates from the researcher being employed in a development management role by a private practice regeneration company since 2003. The role involved participating in regeneration projects involving heritage assets which proceeded to completion such as the Midland Hotel, Morecambe, (RIBA, 2010, p.134) whilst others, the Littlewoods Building, Liverpool have been stalled (Waddington, M, 2012). This has lead to the want to explore why some projects are successfully completed whilst others fail identifying key enabling factors that facilitate the successful delivery of these regeneration projects. This places the researcher as an insider who has practiced in the subject area and due consideration is required to understand how this affects the structure of the research project.

The regeneration of heritage assets is seen as a key urban regeneration initiative in the United Kingdom by central government who have expressed a commitment to promoting these projects as a key regeneration policy initiative due to their potential to regenerate derelict sites and stimulate economic activity in the immediate locality. (Communities and the Local Government, 2010). English Heritage, the government's statutory adviser on the historic environment, argues that there is a strong economic case for regenerating historic assets and that they can play a central role in achieving successful regeneration (Deloitte et al, 2013). Bullen and Love (2011, p.411) argue that there is growing acceptance that conserving heritage buildings provide significant economic, social and cultural benefits.

The role of the private sector in delivering successful heritage lead regeneration is increasingly important. The move towards "neo-liberal" politics (Jones and Evans, 2008, p.2) resulted in a shift away from public sector delivery, to the private sector development community, who have been encouraged via policy and funding initiatives to engage and become lead developer in these projects.

Examples of private sector lead delivery of heritage lead regeneration projects include the Fort Dunlop building in Birmingham where a 376,000 sq.ft former tyre factory was regenerated into a mixed-use commercial, retail and leisure development. The completed development has attracted £40 million of private investment with 2,000 people now employed at the site (Amion Consulting, 2010, p.9). The regeneration of Gloucester Docks, a former derelict dockside has resulted in the restoration of 14 historic buildings and 12 hectares of derelict land. It has attracted £134 million of private sector investment delivering new retail, commercial, leisure and residential accommodation and delivered wider economic benefits including enhanced transport infrastructure and increased in visitor numbers to Gloucester town centre. (Amion Consulting, 2010, p10).

However a plateau or fall in public and private sector investment and the abolition of quasi public sector Regional Development Agency organisations who were significant investors in heritage, coupled with major changes in planning policy is affecting the delivery of these projects (Drivers Jonas et al, 2005, p.17). There are 1,400 heritage assets currently listed on English Heritage “Buildings at Risk” register (Colliers et al, 2011, p6).

Examples of stalled regeneration projects involving heritage assets include Healy Royd Mill, Burnley where a developer has been unable to create a viable scheme to bring forward delivery (Colliers et al, 2011, p28). The project involving the former Bass Maltings site in Sleaford project is stalled due to the inability to raise the required finance to provide the necessary infrastructure to the site to ensure scheme viability (Colliers et al, 2011, p20). The Murrays Mill complex, considered one of the most important Grade II* listed early industrial structures in the United Kingdom remains vacant due to the withdrawal of a commercial development partner following a £11.4 million gap funding investment by the North West Regional Development Agency required to facilitate scheme delivery (Heritage and Regeneration UK Limited, 2009).

Issues with the regeneration of historic assets include the difficulty of estimating the costs of adapting historic buildings in comparison to new build projects and the perception that it more economical to demolish and reconstruct buildings than reuse. (Bullen and Love, 2011, p.417). Colliers et al state that there are many challenges in securing investment in heritage assets and that they are not generally seen as a mainstream property investment by large financial institutions and property companies (Colliers et al, 2011, p8).

Literature Review

A review of academic literature revealed that the focus of debate concerns the delivery of a more holistic approach to conservation including how to broaden heritage definitions to recognise historic assets that do not afford listing status, the development and implementation of conservation management plans and the importance of public consultation in regeneration projects involving historic assets.

Holistic conservation

Hudson and James (2007, p.257) highlighted the danger of the perception that the designation of historic assets is within the preserve of highly qualified individuals and specialists with minimal involvement of the local community. The Sustainable Development of Urban Historical areas through an active integration within towns

research project (SUIT) advocates enlarging the definitions of urban heritage by adopting the term “urban fragment” to identify areas of cities which have architectural or sociological coherence. This ensures that assets are encompassed such as public spaces or settings that would not previously be considered items of special interest and therefore not warrant protection (European Commission, 2005).

The Burra charter developed initially in 1979, promotes a conservation approach based on an explicit value based assessment of the historic environment recognising that individuals, groups and specialist interest groups may value historic assets in different ways. It advocates the use of the term “cultural significance” to assess the attributes of a place that makes it of value to its local community in order to encourage inclusivity in the delivery of historic assets. It promotes a progressive and practical approach to conservation based on the development of a conservation management plan centred on the principles of understanding the significance of an asset, developing policies to protect and manage future change and manage the asset in accordance with the developed policy (Marquis-Kyle and Walker, 2004, p.31). Similarly Semple Kerr (2000, p.1) emphasises the importance of a conservation plan and provides worked examples of this approach in practice. The creation and adoption of conservation management plans is considered integral to providing a holistic approach to overall conservation management in World Heritage Sites to ensure effective and active involvement of all stakeholders (English Heritage et al, 2009, p7).

Public Consultation and Community Involvement

The issue of consultation and community involvement in projects involving the regeneration of historic assets is a current issue of debate in academic research. The European Commission report (2005, p.14) emphasises the importance of inclusive community consultation throughout the regeneration process, providing examples where insufficient consultation resulted in confrontation between the client group and local community resulting in delays to the regeneration process. Semple Kerr (2000, p.36) outlines the importance of ensuring progressive consultation with local communities to ensure the creation of an effective and deliverable conservation management plan. Clarke (2001, p.69) argues that in order for conservation management plans to adequately reflect the significance of an asset then input and consultation with stakeholders is vital.

The researcher recognises the importance of conservation policies and initiatives that promote positive conservation (Deloitte et al, 2013, p7) as it can contribute to the revitalisation and protection historic areas through sustainable and managed development rather than policies which are solely concerned with the preservation of an asset. However the current debate between academics and conservation practitioners does not provide all of the answers to the aims and objective of the research project. Whilst it provides a framework for development that reduces the risk of loss of cultural significance it does not provide much guidance on the wider issues of economic and social success in regenerating historic assets and particularly how the private sector can be involved in this.

Extended Literature Review - Progress update

Progress has been achieved in relation to the research projects aims and objectives following completion of an extended literature review where initial findings will form a basis from which to commence data collection. Jones and Gripaios (2000, p.224) claim that successful regeneration should comprise projects, which make a successful

economic contribution to an area: act as a catalyst for growth and contribute to community spirit and environmental sustainability. They argue that regeneration, which is overly reliant on public sector funding and fails to deliver long term and sustained benefits cannot be considered successful regeneration. (Jones and Gripaios 2000, p.227). Inherit (2007, p.113) advocates good design as an essential requirement of successful regeneration.

A previous United Kingdom government review of the process of regenerating historic assets described it as risky, costly and labour intensive (HM, Government, 2004, p.3). It reported that the process was flawed due to the complexity of the approvals required to obtain the necessary permissions and consents: lack of and unsuitably qualified local authority professionals to administer applications and a complex funding regime that it is constantly changing and difficult to understand. The department of Communities and Local Government has recently implemented significant changes to national planning policy, which is currently ongoing in order to address some of the issues raised (Deloitte et al, 2013, p34).

Key enabling factors affecting the current process.

Key enabling factors have been identified that have a significant on the delivery of these projects, most notably: the public sector, value, the private sector development and investment community, the role of partnerships, return and risk. The role of the public sector as a key-enabling factor, either as a project partner, as a funder or an infrastructure provider has been highlighted (Heritage and Regeneration UK Limited, 2009, p.16). The Inherit report (2007, p.43) outlines the importance of creating partnerships and ensuring public sector involvement to ensure commercial viability and attract private sector investment. The value of public sector funding was demonstrated to have been vital in attracting private sector finance (Jones and Gripaios, 2000, p.224)

Lichfield (1988) commented on all aspects of the concept of value and its effect on delivering heritage regeneration projects. Rypkema (1992, p.6) discusses the economic, cultural, social, urban context and historical value of regenerating historic assets whilst Tiesdall et al (1996, p.11) emphasise the importance of the issue of economic value as a key determinant in the successful regeneration of these projects. The subjects of risk coupled with the need to achieve a certainty of return, was described as a key driver for the private sector development and investment community when appraising whether to participate in a development project (Havard, 2002). Colliers International state where buildings are at the margins of viability, the increased cost and risk of regenerating historic assets can influence developers in whether to proceed or seek opportunities elsewhere (Colliers et al, 2011).

Research Strategy

Ontological and Epistemological positioning

The ontological and epistemological positioning of the researcher in relation to this project is the adoption of a pragmatic ontological stance associated with mixed-methods research. Pragmatism (Creswell, 2007, p23) offers the opportunity for the selection of multiple research methods to overcome weaknesses associated with adopting an “either or” approach. It is focused on an explicit value orientated approach to producing practical research solutions to real world problems. It promotes the creation of theories that inform actual practice. Whilst the focus of a

doctoral thesis is the creation of a robust academic research project: an objective is to create a weighted idealised process matrix to provide practical guidance about the key factors to consider when regenerating these assets.

Advocates of pragmatism reject the claims of critics who argue that pragmatism does not adequately resolve traditional philosophical and ethical disputes (Johnson and Onwuegbuzie 2004, p18) by highlighting that it is a philosophy based on a belief that knowledge is viewed as being both constructed and based on the reality of the world that we live in which is tentative and changing over time (Johnson and Onwuegbuzie, 2004, p.18). It is focused on the adoption of a “what works best” approach by using qualitative and quantitative research methods in order to discover a workable solution (Johnson & Onwuegbuzie, 2004, p.16).

Mixed Methods

Mixed methods research has been defined as a research approach where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or languages into a single study (Johnson and Onwuegbuzie, 2004, p.17). Critics of a multi paradigm strategy believe that research paradigms are associated with fundamentally different assumptions and positions and therefore cannot be mixed (Bryman and Bell, 2007, p.480). Similarly Howe (1988, p.10) claims that quantitative and qualitative research paradigms cannot be mixed as they are positioned within incompatible ontological viewpoints.

Johnson and Onwuegbuzie (2004, p.17) reject the incompatibility argument and advocate a mixed methods approach, as they believe it is legitimate to adopt the use of multiple approaches in answering research questions rather than restricting or constraining researchers choices. They argue that adopting a mixed methods approach allows for the stage one-research results to inform the purpose and design of latter stages of the research. Flyvberg (2011, p.313) argues that more often than not a combination of quantitative and qualitative methods will accomplish the task best. Mixed methods research is an evolving research strategy that is gathering support and momentum and has an established research community, (Tashakorrie and Teddlie, 2009), (Greene and Caracelli, 2007) and (Johnson & Onwuegbuzie, 2004)

Insider research

The proposed research setting is the regeneration of historic assets in regeneration areas, a field that the researcher has been employed as a development manager for a private sector regeneration company since 2003. The role involved participating in regeneration projects involving historic assets in regeneration areas from inception through to completion. The researcher is therefore native to the setting and this requires consideration given the potential impact on the research project and associated design.

Brannick and Coghlan (2007) examine the issue of insider research in detail and whilst critics of insider research such as Morse (1998, p.61), state that the roles of employee and researcher are incompatible as they place the researcher in an untenable position: Brannick and Coghlan (2007 p.60) highlight the benefits of a researcher practitioner and their ability to bring a rich knowledge and experience to the research problem. It is the researchers intention to undertake case study research with private sector companies where the researcher is not employed meaning that access to the required level of data and personnel may prove to be problematic (Havard 2002,

p.377). Similarly Creswell (2007, p.515) states that it is important for researchers to have wide access to information in order to produce effective case study research. Nonetheless the researcher advocates insider research as it allows the research practitioner to bring experiential knowledge to the problem which traditional research methodologies may not be able to achieve.

First stage Data Collection - Semi Structured interviews

A two-stage data collection strategy will be adopted for this research project. The purpose of the first stage of data collection is to corroborate the findings of the literature review and allow sufficient time to generate theory. Theory development prior to the collection of case study data is considered essential to provide a blueprint for further study (Yin, 2009, p.36). It is an opportunity to explore the ideas, concepts and beliefs of a range of practitioners and other stakeholders regarding their opinions about what they believe comprises a successful regeneration project. Additionally it will identify key enabling factors that affect the successful regeneration of historic assets and contribute to the debate about the effectiveness of regeneration projects involving historic assets as a regeneration vehicle. It represents an opportunity for the researcher to identify any additional issues that may emerge which affect the current process, which if relevant can be incorporated into the research project.

The rationale and boundaries for selection is to engage with individuals based in the United Kingdom who have been members of a client group involved in a regeneration project involving a historic asset in the United Kingdom during the period from 2008 to the current day. Fourteen key stakeholders and practitioners will be interviewed.

Each interviewee will be asked questions from a generic interview template where the general areas for questioning will include what constitutes a successful regeneration project, the value of regenerating these assets and how the current process will be affected by recent changes in national planning policy. Importantly it is an opportunity for these professional stakeholders to provide an insight into their particular area of specialism and how this impacts and affects the process.

A pilot study involving two interviewees will be conducted in order to ensure that the research instrument functions well. It represents an opportunity to iron out and remove any persistent problems from the interview questionnaire (Bryman & Bell, 2007, p.272). A period of reflection will be undertaken following the completion of the initial pilot study to assess the success in relation to data collection of the initial interviews and to allow for a period of refinement prior to the commencement of the remainder of the stage one data collection process.

The main outcomes of the first stage of data collection is the generation of empirical data about the current process and it allows an objective case study selection method for case studies to be studied in the second stage of data collection. Additionally it allows the researcher to understand if a convergence or divergence of views exists between client group members relating to the research subject area. Finally it allows for the building of substantive theory, which will be tested during the second stage of data collection.

Second stage data collection - Multiple comparative case studies

The second stage data collection research method is multiple comparative case study analysis, using cases identified during stage one data collection to test substantive theory generated from the first stage of data collection and to produce a weighted

idealized process matrix for practical application for practitioners. Substantive theory is defined as theory which relates to a certain empirical instance or substantive area (Bryman and Bell, 2007, p.587).

Case study research is an appropriate methodology in which to answer “how” and why,” questions in research problems (Yin, 2009, p.27). The main aim of this project is to understand why some regeneration projects proceed to successful completion whilst others fail. It is a research method that has previously been used in the field to study building or construction processes (Sutrisna and Barratt, 2007): an objective of this project is to conduct an in depth study of the current process of regenerating historic assets in regeneration areas. Critics of case study research believe case studies are sometimes carried out in sloppy, perfunctory and incompetent manner (Bromley, 1986). Robson (2002, p.18) argues that even with good faith and intention, researcher bias and selectivity can emerge in case study research. It can be a time consuming and expensive research method with many challenges that include clearly identifying the boundaries of the case to be studied.

Two cases representing a range of regeneration projects involving historic assets in the United Kingdom will be selected using the process previously discussed and selection will be bounded by selecting one project that has been progressed to successful completion and one that has been stalled or abandoned. Further restrictive boundaries will include projects being bounded by time and location by selecting projects that have been completed or abandoned in the United Kingdom during the period from 2008 to the current day. This will ensure that the research project captures data relating to the current process of regeneration and that the research area does not become too broad (Baxter and Jack, 2008, p546).

Data collection will be focused on the process of development within each project to generate an understanding of the specific process and characteristics of each development and identifying the similarities and differences in the cases (Baxter and Jack, 2008, p.550). The unit of analysis is the study of the current development process affecting the regeneration of historic assets in regeneration areas. It will involve a study of the key actors, the context of the project, its vision, the interaction of the key parties and partners and an analysis of the outcomes of the project (Sutrisna and Barratt, 2007, p.168). The case studies will be guided by the following propositions, which are necessary to provide direction and focus to the initial stages of case study research:

Table 1: Case Study Propositions

Propositions	Source
The definition of what comprises a successful project is complex with stakeholders having different views	Professional experience
Regenerating historic assets does not conform to a traditional property development process.	Literature Havard, (2002)
Successful regeneration of historic assets requires input from the public sector	Professional experience and literature Inherit (2007)
The role of the private sector in successful regeneration is now increasingly important	Literature Review Inherit (2007)

Key enabling factors that affect the successful delivery of historic assets are value, stakeholder risk and return	Literature review Lichfield (1988) Havard (2002) Drivers Jonas et al (2005)
The delivery of regeneration projects involving historic assets will be affected by current changes in national planning policy.	Professional experience

(table template obtained from Baxter and Jack, 2008, p551- 552)

Due to the flexible nature of this research project, these initial propositions may be modified by the results of the first stage of data collection and analysis. Data will be collected via the research instruments of documentary and archival analysis, semi-structured interviews with project participants and key stakeholders, site visits and observations. Data will be obtained where possible from information sources in the public domain such as local planning authority records. Quantitative data collected will include analysis of risk, development appraisal and investment analysis techniques employed in the process of regenerating historic assets by private sector development and investment companies and public sector organisations.

Data Analysis

Whilst Yin (2009, p.127) believes that multiple case studies is an appropriate method to study built environment projects due to its effectiveness in investigating phenomena in their natural setting, it is considered that the analysis of case study evidence is one of the least developed and most difficult aspects of doing case study research. A general strategy of data analysis will be guided by the theoretical propositions stemming from “how and “why” questions considered extremely useful in guiding case study analysis (Yin, 2009, p.131). Data will further analysed by the research methods of rich picture diagrams and descriptive storylines to ensure systematic and rigorous analysis of data. Rich picture diagrams will enable modelling of complex and rich information and will provide a holistic view of the case study storylines. Data analysis by descriptive storylines will ensure consistent and methodical data analysis that will identify core categories and issues to be studied. The analysis of data on individual case study level will in turn be used to create an aggregated rich picture diagram to provide a visual and holistic view of the storylines and will be used to identify convergence and divergence of issues (Sutrisna and Barrett, 2009, p.939).

Following production of a draft idealized process matrix, a focus group will be assembled comprising of eight practicing professionals from the private and public sector to review the key findings of the rich picture diagram to assess the relevance of its findings in relation to the current process. Conducting focus group interviews represent an opportunity to understand how a group of stakeholders discuss a certain set of issues and to observe what they deem to be significant issues (Bryman & Bell, 2007, p512). A main objective of the focus group is to review the weighting accuracy of the key enabling factors included in the process matrix assembled by order of significance to reflect their impact on the current process. Following completion the process matrix it will be applied to one fresh regeneration project involving an historic asset currently in progress in the United Kingdom to further test the substantive theory and to test the research proposal findings. This final case study will be selected during the course of the second stage of data collection.

Research ethics

Prior to commencement of the data collection phases of the research project, approval has been obtained from the University of Salford research ethics committee to ensure compliance with ethical regulations and committee codes of conduct.

Ethical considerations include informed consent being obtained from all participants (Yin, 2009, p73) with an explanatory note describing the true nature of the research projects aims. Research participants will be provided with as much information as will be needed in order to make an informed decision about whether they wish to participate in the project. (Bryman and Bell, 2007, p137). Issues relating to confidentiality are a key consideration for this research project and the confidentiality of the participant must be honoured if requested.

All observations to collect data will be conducted overtly and collected systematically via structured and multiple data collection research methods to ensure triangulation. The researcher will complete member-checking procedures where all transcripts collected via first stage and second stage interviews will be returned to the interviewees to confirm accuracy in the recording and transcription process. A period of reflection following completion of each phase of data collection will be completed in addition to maintaining a detailed set of field notes to ensure rigour and systemic recording of data collection (Baxter and Jack, 2008, p.556). All data relating to the research project will be stored in a secure password protected online data storage facility.

Positioning Statement and Time-plan

The researcher has provided a justification as to why the research topic is worthy of doctoral study, completed an extended literature review, finalised the proposed research design strategy, obtained ethical approval for the research project and commenced the first stage of data collection. The next stage of the research project is to complete and write up the first stage of data collection and to continue the extended literature review.

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Successes and Failures in the Dutch Housing system

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Abstract

Can the successes and failures in the Dutch housing system be explained by the leadership and management characteristics and behavior of CEO's of housing associations? Housing association in general and their CEO's specific currently are subject of political debate in the Netherlands. Over the last four years several cases of mismanagement and fraud occurred. Some CEO's were even convicted for their conduct. Significant financial damage has occurred up to over 1 billion Euros'. No earlier research has been done within the social housing environment in the Netherlands to explore the relationship between leadership characteristics and management output. Recent preliminary practice based research however does show significant differences in management characteristics among CEO's within the Dutch system which could be an explanation for current failures. Improving the Dutch housing system is the overall aim of the research. The case study will use qualitative as well as quantitative research methods in a triangular approach; cultural beliefs and behavior, management characteristics, and cognitive dissonance.

Keywords

Leadership, social housing, management characteristics, cognitive dissonance, case study

Introduction and context of the research problem

The Netherlands has always, been a strongly 'segmented' country, and that has never completely disappeared. These segments, predominated by religions, different socialist movements, and liberalism, are reflected in a great variety of separate political parties, schools, health care institutions, sports clubs, and social housing associations. The first of the latter were established in the second half of the nineteenth century, and their main objective was to provide better living conditions for the workers from the perspectives of health and safety (Aedes 2007). At the time, there was no relationship between social housing association and government and the initiatives to start a housing association were limited and small-scaled.

In 1901, social housing was given a more solid base with the Housing Act, which made it possible for private organisations, with government support, to build 'for the general good'. So, social housing associations are independent, private organisations that build, rent, manage, and sell homes. They perform this task primarily for people that have economically difficulty in finding good, affordable housing on their own. In order to operate in the field of social housing, an institution must be recognised by the government. The legal term for a housing association, therefore, is a 'registered social housing association'.

These housing associations have to comply with the rules of the Housing Act 1901 and with what in the Netherlands is being described as rules. Through several decades the modes of governance of housing associations changed from private enterprise in the first decades, through central planning from 1945 - 1965, to liberalisation nowadays (Ruys et al 2007). The most recent rule that regulates the operations of the Social Housing Sector is the BBSH (Besluit Beheer Sociale Huursector). The BBSH defines six performance areas. These are six main tasks to which the social housing associations must direct their efforts. These performance areas are the following (Aedes 2007)

1. Assure good quality in all homes
2. Guarantee the financial continuity of the enterprise
3. Rent on a priority basis to the special attention groups intended in policy
4. Involve tenants in the policy and management of the organisation
5. Make a contribution to the quality of life in neighbourhoods and communities
6. Make a contribution to the housing of persons in need of care or supervision.

In addition to these rules, by law, the housing associations have their own Aedes code. Aedes is an organisation for housing associations in Holland. This code states: "Associations must do everything within their power to bring about good housing, in cooperation with the people who call on them to provide housing for them" (<http://www.aedesnet.nl/binaries/webwinkel/2007/2007-01-01-aedescode.pdf> visited August 8th 2012).

The Dutch housing system, unlike most, is relatively old as stated earlier. Aside from quite strict regulation by government the financial structures are specific and different from the systems used in other countries (Lawson & Nieboer 2009). Dutch social housing associations have to fund their financial need through the open financial markets. A system of solidarity through the Centraal Fonds Volkshuisvesting, guarantees of municipalities and guarantees by the central government, provide for securitisation of the loans (http://www.cfv.nl/zoeken?search_type=files&q=solidariteit, visited August 18th 2011). These guarantees have a unique triple A status which is serviced by a special purpose organization called Waarborgfonds Sociale Woningbouw (<http://www.wsw.nl/wetenendoen/hoewerktsw/11>, visited August 18th 2011). The Dutch Housing system is, because of these features, widely respected abroad (Dolata 2008), (Fitzpatrick and Stephens 2007), (Cameron 2009), (Whitehead & Scanlon 2007) (Eickmann 2009), (Boelhauer 2006).

Nowadays in most cases a single professional executive, the CEO, manages a Dutch housing associations. In some cases there is an executive board of two, but in general the CEO is the only board member. In terms of governance the executive board is being controlled by a non-executive board, which regularly has three to five members. They execute their controlling duties in part time. The average housing association in the Netherlands manages 6,000 dwellings. This in average represents a total market value of almost 1 billion Euros per association. So the balance sheet of a Dutch housing association is comparable with a small financial institution or bank.

The very essences of the job are the six tasks mentioned earlier in this paper.

From this four dimensions can be derived, internal focus, external focus, hard targets, and soft target. The way it is executed and the choices to make are up to the CEO.

Running a housing association could be classified an “impossible job”. In their model Hargrove and Glidewell (1990) introduced four dimensions by which one could actually measure whether or not a job in public management can be called an “impossible job”. These dimensions can be specified as:

1. Legitimacy of the commissioner’s clientele
2. Intensity of the conflict among constituencies
3. Public confidence in the authority of the commissioner’s profession
4. Strength of the agency myth

A job, according to Hargrove and Glidewell, becomes impossible when it falls in the extreme end of several dimensions. The first dimension covers the client, responsibility. The commissioner, i.e. CEO, must compete with other commissioners for public recourses. The impossible pole in this dimension applies to commissioners who serve people with social, economical, or emotional problems. The second dimension states that the commissioner has to cope with at least five kinds of different constituencies: political, advocates, opponents, bureaucracy, and regulated groups central to the mission. The third dimension deals with the public respect for the commissioner’s profession. CEO’s working in social services, mental health, and the police are likely to be less respected then their colleagues working in medicine and engineering.

The fourth dimension becomes impossible in the condition that the commissioner’s myth is weak, unstable, and controversial. In fact when it lacks sufficient public appraisal the job eventually will become impossible.

If these criteria by Hargrove and Glidewell really do apply on the CEO’s of Dutch Housing association is part of this research later on. For now they are an indicator for potential difficulties in executing a job in a public service, on an open market without real market discipline. Veltrop (2012) cited Smith (1776) by saying “ the directors of such companies... being the manager rather of other people’s money than of their own, it cannot well be expected, that they should watch over it with the same anxious vigilance with which the partner in a private copartnery frequently watch over their own... Negligence and profusion, therefor, must always prevail, more or less, in the management of the affairs of such a company.”

Efficiency, leadership and finance

From 1994 Dutch housing association fund their financial needs through the open financial market, backed by government guarantees. Although financial efficient, these limitless guarantees can be problematic too. Koolma (2001) (2008) studied this phenomenon and his findings and conclusions were quite sufficient this paper would state. He proved in his research that cheap money and getting this money quite easy could lead to moral hazard and lack of organisational efficiency.

More recently Koolma, together with Gerrichhauzen (2011), states organisational inefficiency is, rather than being caused by bad governance or failing regulations, being caused by a lack of leadership. This view is backed by the research results of Brummelhuis (2009). According to Brummelhuis, CEO’s of Dutch housing

association overestimate their abilities frequently and in that way deliver bad leadership. This efficiency debate on Dutch social housing association from 2008 got more political attention. Incidents involving projects with massive loss and massive costs drew attention by politicians and the overseeing body CFV. Kahnemann (2011) described this failure by showing that people take big risks in order to avoid loss.

Decision makers, including CEO's of Dutch housing associations, can easily be tempted to do something else than what they know is right. And as we know now, some of them did. In his research Brummelhuis (2009) showed that overconfidence plays a major part in the professional life of a CEO of a housing organisation. Earlier De Kam (2007) researched behaviour of social housing associations on the Dutch land market. During his research de Kam also found evidence of non-professional behaviour. Housing Associations paid far more for the same piece of land than private parties would have done. They sometimes spend it on the wrong land and neglected internal governance rules. At this very moment several CEO's of social housing associations face charges in criminal court because of that behaviour (<http://www.nrc.nl/nieuws/2011/12/13/staat-legt-miljoenenclaim-neer-bij-commissarissen-woningcorporatie/> visited December 26th 2011).

Apparently, CEO's of Dutch housing associations in some cases - to the public eye regarded as many cases - do not act responsible. To Selznick (1992) Responsibility is something else than accountability. Rather than looking for external standard a person should have an 'inner commitment' to moral restraint and aspiration. Public appraisal is low and public legitimacy to the job is deteriorating.

Rationale for the research program

To find out if the personal characteristics and cultural beliefs of CEO's of Dutch housing associations contribute to success and failures of these organisations is the main object of this research. Wright Mills (1959) stated it this way: 'Neither the life of an individual nor the history of a society can be understood without understanding both'.

The research will use earlier research of Geert Hofstede (1991, 2001), Manfred Kets de Vries (1993, 2003), and Leon Festinger (1957) in order to get a triangular view on the topic. Using Hofstede the aspect of the importance of culture will be addressed. In many, many years he investigated the effect of cultural consequences for countries and organisation. Manfred Kets de Vries's research track record shows a wide range of insight on how a company should be run. So by applying his research a managerial insight on Dutch housing associations can be constructed. Finally, through Festinger's research on cognitive dissonance the research will ideally get an in depth understanding in decision-making processes. It will show consistencies or inconsistencies in behaviour of the CEO's given certain circumstances.

The importance of cultural beliefs

Important however is the fact that his research draws the attention to the role that CEO's have within the system. And from this perspective it is a relatively small step to understand that the professional attitude of a CEO will be formed or influenced by the set of beliefs this CEO has.

Beliefs can be defined as 'propositions about the world in which a person is at least minimally confident' (Hedstrom et al 2009). From this definition one can derive many

positive aspects in Human live in general. In order to lead a decent life humans have to have certain believes. But having certain believes can also lead to problems. First there is the problem of overreliance to which Brummelhuis reflects, second there is the problem of selection bias. This latter problem can be explained by a simple example; vivid information is being remembered better than pallid information (Hedstrom et al 2009). This selection bias in combination with overreliance can be a major contributor to making the bad decisions.

Case study research

It is decided to choose Case Study as the methodology for this research in which the group of housing CEO's are considered to be one case . The case study methodology 'allows investigators to understand complex social phenomena, to retain the holistic and meaningful characteristics of real-life events, small group behaviour, organisational relations, and maturation of industries' (Yin 2009). The case study researcher 'typically observes the characteristics of an individual unit, a class, a school, or a community. The purpose of such observation is to probe deeply and to analyse intensely the multifarious phenomena that constitute the life cycle of the unit' (Biggam 2011). It is in short explanatory, descriptive, and exploratory.

Case Study commonly is being used in association with the term 'location' and it is being associated with the concept of qualitative research. In many cases the later is incorrect. Frequently Case Study is being used for both quantitative and qualitative research (Bryman 2008). Case Study according to Knight et al (2008) is 'considered to be appropriate in new areas or to provide different perspectives'. Creswell (2009) stated that Case Studies are bounded by time and activity, and researchers collect detailed information using a variety of data collection procedures over a sustained period of time. Jarvis (1998) refers to the value of Case Study especially for practitioner/researchers. Case Study provides complete descriptions, experiential and holistic perspectives, simplifies without losing integrity, and gives more in-depth communication than propositional language can provide.

Case Study usually involves multiple research methods (Atkinson et al 2001) and in this particular research it will be the same. Interviews, using existing and specially designed questionnaires, will be conducted. Hard data from agencies such as CFV will be analysed. Qualitative methods developed by academics as the cultural dimensions by Geert Hofstede (2001), the dynamics of individual and organizational change by Manfred Kets de Vries (1993), and cognitive dissonance by Leon Festinger (1957) will all be used in order to create a viable and trustful picture on cultural believes and possibilities of acting in cognitive dissonance. Hence the essence of a case studies is 'to try to illuminate a decision or set of decisions; why they were taken, how the were implemented, and with what result' (Yin 2009). As Flyvbjerg (2011) stated one could write 'wirkliche Historie' in which the researcher operates on the basis of three premises:

1. Researchers are both involved in, and partially produced by, the same cultural practices which the study; hence, researchers cannot stand completely outside of that which they study; researchers are not identical with that which they study, however.
2. Practices – what is done – are more fundamental than discourses, including theory and theoretical discourses; practises are here understood as a way of acting and thinking at once.

3. The meaning of discourses can be understood only as a part of society's on-going history.

Explaining Hofstede briefly

Culture is learned, not inherited (Hofstede 1991). Every person has his own unique patterns of thinking, feeling, acting, and learning which were adapted throughout their lives. Hofstede states that culture must be divided in two forms; culture one, and culture two. Culture one refers to education, literature, and art. Culture one is relatively distant to one's personality rather than to a group of people. Culture two defines the personality. It defines how people eat, greet, show their feelings, or maintain hygiene. "Culture two is always a collective phenomenon, because it is at least partly shared with people who live or lived within the same social environment, which is where it was learned. It is the collective programming of the mind which distinguished the members of one group or category of people from another" (Hofstede 1991).

Core of the different cultures is formed by values in which values are broad tendencies to prefer certain states of affairs to others. Values are the first things children learn; good vs. bad, ugly vs. beautiful, dirty vs. clean.

From these basic perspectives Hofstede constructed, in his active period with IBM, a theoretical scheme in which he could separate one cultural phenomenon from the other in different countries. Hofstede distinguishes five separate scales for this. In short these scales are:

1. Inequality in society, measured through a Power Distance Index, PDI. Inequality is all around society and through measuring this one can define how a country or organisation handles inequality. From this one can understand that some people have more power than others, or actually have power over others. Some societies consider this as a good thing others consider it a problem. In spite of trying to achieve equality by law in many countries, it is seldom completely perceived. Hofstede researched this phenomenon in many countries and found that for instance PDI in Mexico equals 81 on a scale of 100, Austria on the other hand scored 11 on the same scale. This indicates more inequality in Mexico than Austria.
2. Individuality in society, measured through a scale of Individualism, IDV. According to Hofstede people have different perspectives of the role of personal relationships in society. For Swedes for instance, business is done with a company. For Saudis one does business with a person whom one has learned to trust. This difference addresses a fundamental issue in human societies; the role of the individual versus the role of the group. Individualism can be defined as the loose ties between individuals. Collectivism can be defined as integrated cohesive group behaviour. From Hofstede's research on this scale of IDV in the USA the average score would be 91 on a scale of hundred. In Guatemala however the score would be 6, indicating that Guatemala is, not to anyone's surprise, a more collectivist society.
3. Genders and gender roles in society, measured through a scale of Masculinity, MAS. The difference in behaviour distinguished by gender is Hofstede's third perspective. Men and women have different needs and have a different way of achieving their personal goals. Typical masculine needs are recognition, advancement, and challenge. Typical feminine needs are cooperation, security,

and a personal environment. From Hofstede's research it can be distilled that Japan scores 95 on a scale 100. On the other end of the scale Sweden score only 5 points.

4. People have different ways coping with risks. What is different is dangerous. Extreme risks and uncertainty for instance can create intolerable anxiety. The difference in how people handle uncertainty is therefor the fourth scale in Hofstede's system. The Uncertainty Avoidance Index, UAI, measures it. UAI was originally considered as a by-product of PDI, but got its own index within the system because research result showed regular patterns of differences between different societies. Within this scale Belgium scores 94 out of 100. Singapore however, who would have thought that, scores only 8 out of 100. So this indicates that people in Singapore are less troubled about their future then Belgians.
5. The fifth and last dimension on Hofstede's scale was introduced in 1985, after research that has been done in China: Long Term Orientation, LTO. From this research it was clear that the way people look at the future should be an independent part of the original scheme. People with a long-term orientation value persistence and having a sense of shame. People with a short-term orientation tend to value aspects as respect for tradition and reciprocation of greetings, favours, or gifts. Coming from research in China it will be no surprise that Hong Kong scores 96 on a scale of 100 on LTO, Nigeria scores a mere 16.

The Hofstede system delivers certain characteristics on an individual level. The table shown below is explaining this.

Table explaining individual characteristics by Hofstede system

Category	Characteristics lower scores under 50	Characteristics higher scores over 50
Power Distance Index PDI	Low dependence needs Inequality minimised Hierarchy for convenience Superiors accessible Equal rights for all Change by evolution	High dependence Inequality accepted Hierarchy needed Privileges for people in power Change by revolution
Individuality IDV	'We' consciousness Relationships have priority over tasks Obligations to society Penalty implies shame	'I' consciousness Private opinions Obligations to oneself Penalty implies loss of self respect
Masculinity MAS	Quality of live serving others Consensus Work in order to live Sympathy for people in need	Need to excel Tendency to polarise Live in order to work Big is beautiful Admiration for achiever Decisiveness
Uncertainty Avoidance	Relaxed	Greater stress

Index UAI	Flexibility Less need for rules	Work hard Need to avoid failure
Long Term Orientation LTO	Absolute truth Conventional Quick results	Many truths Acceptance for change Perseverance

Results on the preliminary research

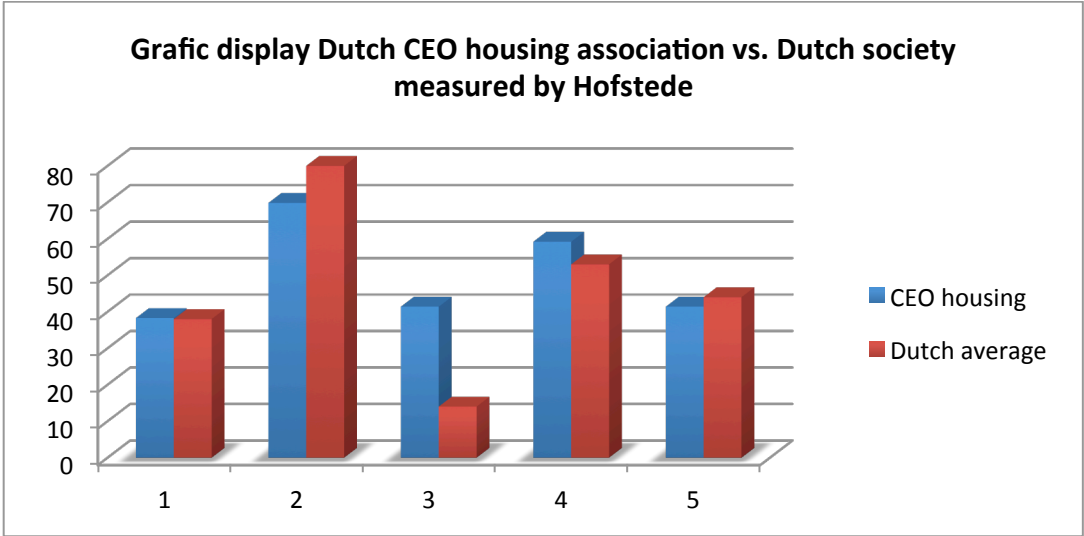
During a preliminary practice based research 53 CEO's of housing associations were interviewed personally on location virtually across the whole of the Netherlands. During visiting the first participants it became clear that getting information from other CEO's from other businesses could be vital. Hence it would make clear whether or not the data from the original group showed significant differences that could be explained as job related. A group of 8 CEO's of a cooperative bank, called Rabobank, was asked to do the questionnaire. Later on a group of 6 CEO's of constructing companies was asked to do the same. The CEO's of the cooperative bank were chosen for their job has certain similarities with that of CEO's of housing associations. They cover the same amount of customers, and are responsible for roughly the same annual turn over. The CEO's of constructing companies were chosen because their line of work covers the other end of the job spectrum of a housing CEO; building things. Using a small sample could provide statistical error (Kahnemann 2011). Interviewing an HRM director of a Dutch bank solved this. During the interview, without knowing the results of earlier research results, he reconstructed a profile of the ideal banking director using Hofstede. What he constructed confirmed the results taken from the interviews. Selection of participants from housing associations was at first related to the researcher own network. After doing some test questionnaires the selection was random.

The average age of our participants is 55 years. The oldest participant was 64 years old, the youngest 37. The company size was in average 10,800 dwellings. This is slightly more then the actual average company size, which counts for approximately 6,000. The largest company involved counted 42,000 dwellings, the smallest 900. Gender wise a representative amount of women were involved. The first general results on the Hofstede questionnaire displayed in graphic 1 for CEO's of housing associations in comparison with average Dutch society.

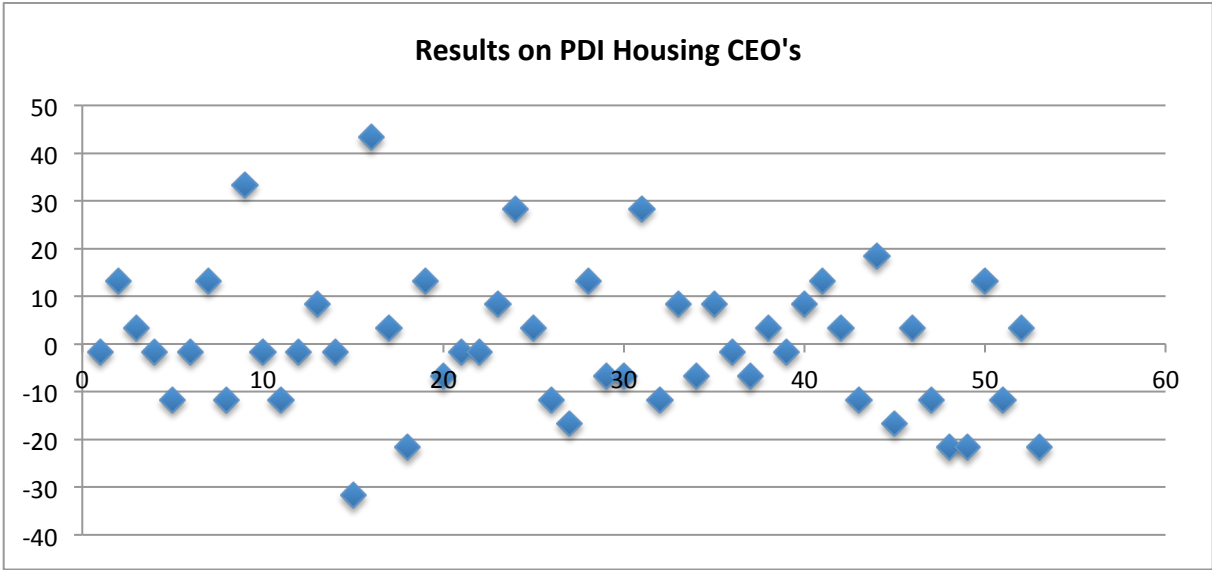
The results PDI show a rather large volatility as is shown in the graph 2. This was not noticed in the first half of the research. Half way through the interviews it became clear that this outcome could indicate a relationship between cultural beliefs and performance as described in the research question. Volatility on PDI can be an important indicator for aberrant behaviour on the job (Hofstede 1991). According to Hofstede scores on PDI in close relation to scores on UAI are the main indicators for a company's identity and culture.

Before drawing any conclusion from this volatility the research put the questionnaire to CEO's of a banking organisation. If they would show the similar results, the scores by participants of housing association have little relevance. Matching these results some significant differences occurred. Although the average score is exactly the same, the score within the group of banking CEO's was much more coherent as shown in graph 3 below. Please note that in the result of participant 1 in this group, accountable

for the largest difference, held the job on an interim basis. As stated earlier a HRM director of a Dutch bank confirmed our findings.



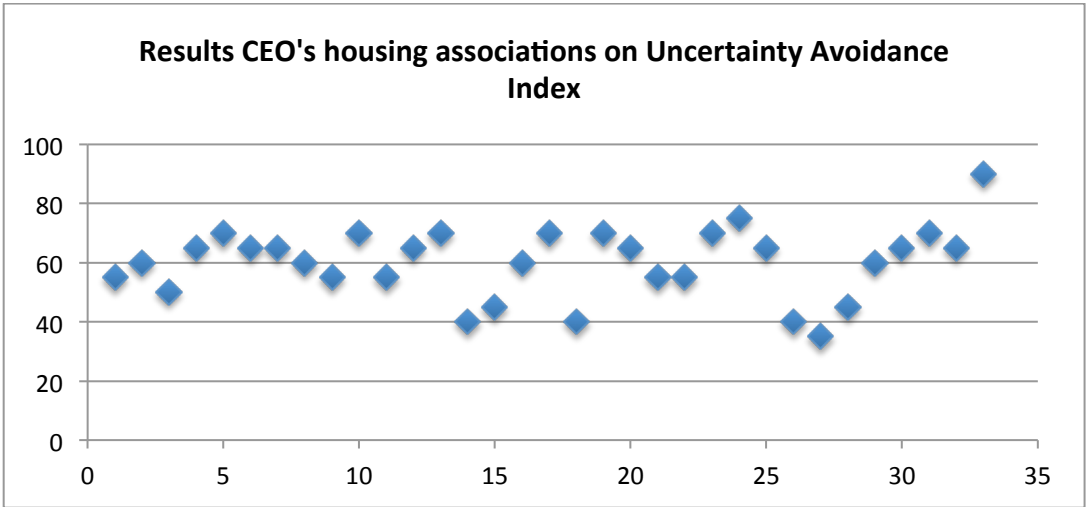
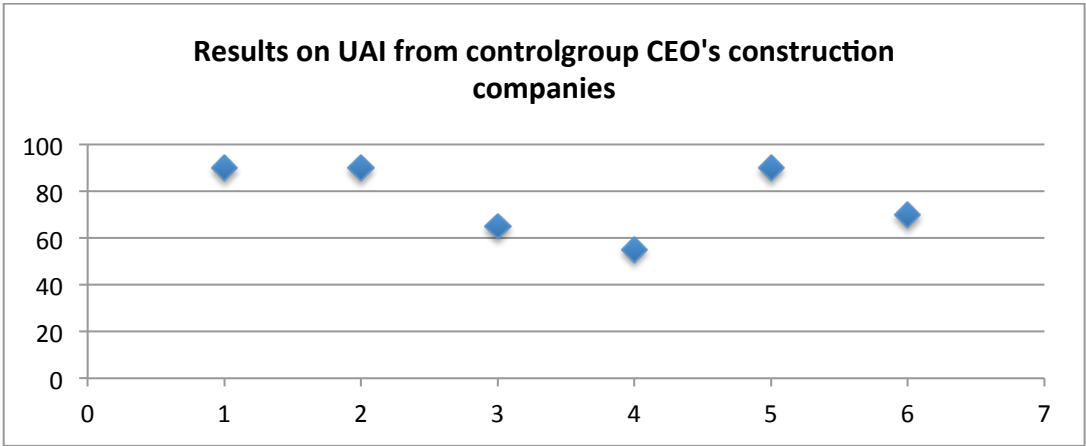
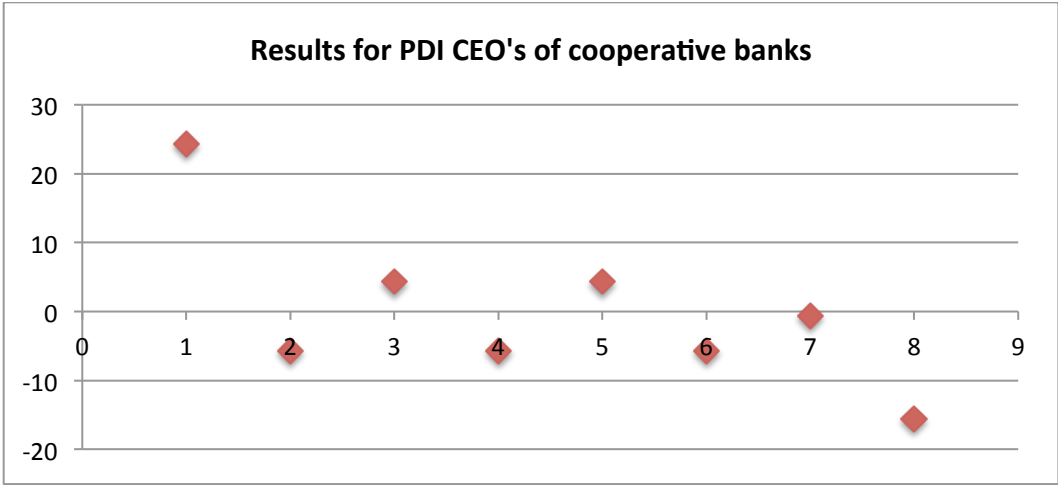
1 = Power Distance Index, 2 = Individuality, 3 = Masculinity,
4 = Uncertainty Avoidance index, 5 = Long Term Orientation



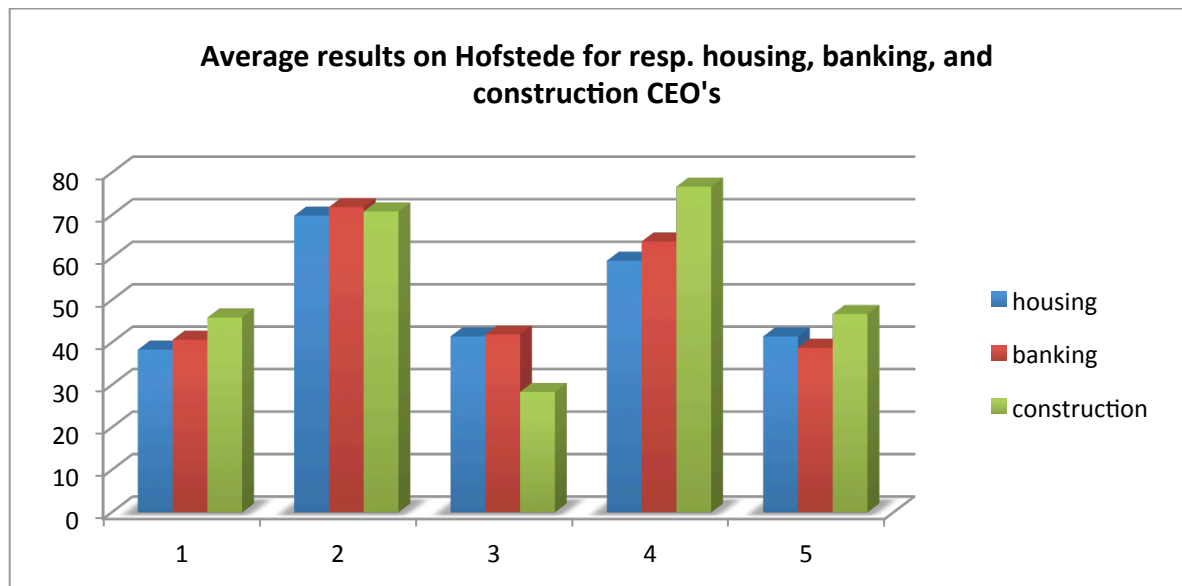
Although the measurements on the control group 1 up until now are rather small in numbers, the significant difference between these CEO’s and housing CEO’s becomes clear. For whatever reason the banking group is more coherent in their scores. This could indicate on having more focus on the job or more coherent selection when being appointed to the job.

If we take a look at the second control group on PDI it shows, a similar picture as shown with the banking CEO’s. There is also more coherence within this group then measured with the housing CEO’s. But in the second control group another significant difference occurred. Measuring the Uncertainty Avoidance Index, again CEO’s of housing associations show an average score of 60, whereas CEO’s of construction firms showed an average score of 76. One would expect this the other way around, or

at least equal high, because of the fact that avoiding uncertainty should be a primary target when operating in a high-risk environment as CEO's of housing associations do. This difference is showed in the next two graphs.



The overall average result of the three groups on the questionnaire are as shown in the Graphic 6 displayed below.



1 = Power Distance Index, 2 = Individuality, 3 = Masculinity,
4 = Uncertainty Avoidance index, 5 = Long Term Orientation

On the scale of PDI, and LTO there are differences between the three groups, on the scale of MAS, and UAI there are significant differences in the data.

Keeping Hofstede's explanations in mind CEO's of construction companies are more 'careful' in their personal beliefs and cultural patterns. They show more respect for legitimate power (PDI), they tend to have more feminine (!) needs and behaviour, they are more aware of risks and uncertainty, and they are longer term orientated than the other groups.

Conclusions

Can the successes and failures in the Dutch housing system be explained by the leadership and management characteristics and behavior of CEO's of housing associations? The preliminary results on the Hofstede Questionnaire for CEO's of housing associations used in this research indicate it can. The volatility in data tends to give evidence that either it is behaviour by choice of the CEO or that the people in charge of appointing a CEO tend to appoint someone without realising the potential impact of certain personal beliefs. It is also possible that the performance areas as shown earlier in this research are defined in a way that they can be interpreted in different ways and that there is a certain legitimacy in getting volatile results. One way or another the other groups in this research show more coherence and more focus. For banking CEO's there must be focus on financial results, for construction CEO's the focus is based on continuity. CEO's of housing associations should ideally have both qualities. The results so far indicate several types of selection on appointing

a CEO. At RABOBANK selection is strict, being a successful constructor depends the agility one has to the market, at housing associations apparently no selection criteria are applied. Whether or not that is a good thing will be researched in the next phase of this doctoral journey.

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Peri-urban Land Use Change in the Lagos Megacity

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Abstract

Land use and land cover monitoring and assessment is crucial to proper planning and sustainable development. Periodic information on urban development and land use changes are necessary for peri-urban regions undergoing rapid changes. Detecting changes in land use requires timely and accurate spatial information, which using remotely sensed data and GIS guarantees. The sporadic population growth in the Lagos megacity region coupled with ever increasing the demand for urban land use has undoubtedly exerted pressure on the existing peri-urban landscape and its intrinsic natural resources, which include forest and valuable agricultural lands in Ikorodu, Lagos. The utilization of multi-temporal Landsat imageries to monitor the dynamics of conversion of forest and agricultural land uses to urban land use between the periods of 1990 to 2011, as well as its implications is the motivation of this research.

Keywords

Land use, land cover, peri-urban, remote sensing, GIS

Introduction

Megacities are trending phenomenon of urbanization having enormous impact on global economies, cultures, and environment. The growth of megacities in developing countries is characterized by sprawling fractals, especially in the peri-urban areas of cities; this defers from compact aggregations of settlement seen in the North. The consequences of this sprawling development are reflected in economic, social, health and environmental problems, which poses a great deal of challenge to environmental sustainability at both local and global scales.

In most developing economies, the sustainability challenges that comes from sprawling expansion of cities, which is synonymous with informal land use and tenure, disorderly subdivision layout patterns, lack of public infrastructure and services, poverty, informal livelihood, increased social and economic costs, environmental degradation, loss agricultural land and diminution of natural resources like forest and high-biodiversity wetlands. Furthermore, these impacts are mostly felt in the peri-urban zones (Lawanson, Yadua, & Salako, 2012; Fragkias, et al., 2012).

Studies on the growth of the Lagos Megacity corroborate the generic consequences of spatial expansion and peri-urbanization. These consequences also reflect the challenges and ineffectiveness of physical planning at a megacity scale and the dominance of unsustainable land use planning decisions. Peri-urbanization have been often ignored by urban planning professionals and city managers; however, appropriate land use planning decisions at various spatial levels can minimize future

unsustainable land use changes, which is a major driving force of global environmental change (Grimm, et al., 2008). Achieving sustainability requires an urgent need for spatially explicit and interdisciplinary research to provide a better understanding of the land use change processes, analysis of past and current trends of land use change, the effect of megacities expansion on the peri-urban zones.

This paper examines the use of remote sensing to monitor spatio-temporal land-use and land-cover changes for one of the peri-urban local governments in the Lagos Megacity under consideration using LANDSAT Multi-temporal and multispectral images for a period spanning two decades (i.e., 1990 to 2011); policy implications are also discussed. Further investigations not covered within the scope of this paper include investigation on the drivers of peri-urban land use changes and spatial models for predicting future land use changes and impacts in the megacity.

Description of the Study Area

Ikorodu is a local government area (municipality) of Lagos State in Nigeria. With an area of approximately 396.5 sq. Km. It is spatially located approximately 36km North of Lagos between longitude 3.43° W and 3.7°W and latitude 6.68°N and 6.53°N north of the equator. The municipality has been known for extensive farmlands since the 1960's; due to its farming significance, the defunct Western Nigerian government acquired and designated several hectares of land for one of its farm settlements.

Apart from farming, fishing and trading are basic sources of livelihood by indigenes of Ikorodu, which also accommodates the largest industrial estate in Nigeria (1,582.27 hectares of land). The municipality had a 186-percentage population growth between the 1991 and 2006 censal years (i.e., from 184,674 to 527,917). As noted in the Lagos Metropolitan Master Plan 1980-2000, Ikorodu forms part of the Lagos Metropolitan Area and this is seen the daily high commuter traffic, especially during peak periods.



Fig. 1 Map Showing the Study Area within the Lagos Metropolitan Area

Literature Review and Conceptual Framework

Remote sensing provides new tools for sustainable management of the built and natural environment. The collection of remotely sensed data facilitates the synoptic analyses of land use change and patterns over time in various spatial scales (local, regional, and global); by utilizing remote sensing technologies integrated with GIS

mapping techniques, land use and land cover change of designated areas can be monitored and mapped for specific research and analysis.

Remote Sensing is the science and art of obtaining information about an object, area, or phenomenon through the analysis of data acquired by a device that is not in contact with object, area, or phenomenon under investigation (Aronoff, 2005).

Land-use and Land-cover are two different concepts that has become a central component in current strategies for managing natural resources and monitoring environmental change. Land-use refers to the purpose or activities for which land is used. It emphasizes more on land's social properties, that is, the output of reconstruction activities that human adopts to manipulate, manage and regulate the land chronically and periodically according to determinate economic and social purpose. Land-cover on the other refers to the physical and biological cover over the earth surface of land, including water, vegetation, bare soil and artificial structures. It emphasizes particularly on its natural properties, it is defined as the biophysical cover of the earth's surface, and it is the expression of human activities and synthetically reflection of various elements in global surface covered with natural body or synthetic features (Ellis, 2010).

Land Use Change and Sustainability: From Global to Local Applications

Land use change is central to the sustainability debate; it is a major driving force of global environmental change and it affects the earth systems as seen in literature. Impacts of land use/land cover change are felt from global to local scales; there is world wide biodiversity loss, global deforestation, global climate change via carbon circle, soil degradation and ability of the biological systems to support human needs.

In furtherance to achieving sustainability at global levels, a research plan was developed in 1995 by the International Geosphere-Biosphere Programme (IGBP) aimed at understanding the nature of land use/ land cover change and its impacts. The research foci include land-use dynamics of various regions of the world, which represents the major clusters of LUCC dynamics worldwide, thereby permitting spatial and temporal fine-tuning of the overall global models of land use change.

At the local scale, substantial amount studies on land use/land cover change have been devoted to deforestation and transformation of rural land with remote sensing being a principal tool for analysis. The first nationwide land use study was the Nigerian Radar (NIRAD) Project initiated by the Federal Department of Forestry in 1976/77. The radar imagery covering the whole country was acquired using SLAR (Side-Looking Airborne Radar) at a scale of 1:250,000.

In 1996, the second nationwide land use and land cover mapping project was carried out to ensure sustainable use and conservation of the nation's forest resources and biodiversity established by FORMECU (Forestry Management Evaluation and Coordination Unit), a unit established in the Federal Ministry of Agriculture and Natural Resources. The project assessed the land use and vegetation changes in Nigeria between 1978 and 1995 with the aim of developing programs for monitoring vegetation changes and degradation over time in the country. This task was carried out using multi-sourced and multi-temporal remote sensed imageries such as Landsat MSS (1976/78), SPOT Multispectral (1993/1995), Landsat Thematic Mapper TM (1993), ERS-1 Radar (1994/1995), JERS-1 Radar (1995) NOAA and AVHRR (1978, 1986,1990, 1995).

The FORMECU project yielded a robust countrywide GIS database consisting of enhanced and interpreted satellite and radar data. From the GIS database, complex analyses of the land use change, detailed national and state-by-state change scenario over the 18 years period were generated. These products significantly reflected the human-induced land use change in Nigeria over time and its impact on water, vegetation and soils. However, scholars noted that the FORMECU project had limitations similar to the NIRAD project due to its small-scale production of 1:250,000 and overgeneralization, even though it gave room for spatio-temporal analysis of land use at the national scale (Ademiluyi, Okude, & Akanni, 2008).

At the city scale, empirical studies have revealed the significance of land use change and sustainability research in is the efficient management of land resources, which is dwindling with the ever-increasing urban population. More so, it is obvious that most global environmental changes and associated hazards are caused by locally human induced land use and land cover change. However, a major gap identified in all these studies is the regional and metropolitan level focus without giving attention to dynamism of land use changes in lower levels of urban planning districts and smaller towns in peri-urban areas, which are cummulatively very significant.

Existing studies carried out to analyse spatial and temporal changes of megacities, with a focuss on peri-urban land use changes are very few and are dominated by scholars in the global north (Bell & Irwin, 2002; Irwin, 2003; Theobald, 2005; Huang, Zhang, & Wu, 2009). According to the joint workshop report by the Urbanization and Global Environmental Change Project and the Glogal Land Project, there is dissimilarities between the northern and southern countries in the speed, scope and experience of urbanization and peri-urbanization. Thus, peri-urbanization literature coming from a North-American context might not easily be transferable to other regions/cultures/governance regimes and we must be that much more wary of our interpritation of the processes in the Global South (Fragkias, et al., 2012).

In view of this gap, there is a need for studies and historic perspectives on the spatial transformation of the peri-urban areas that contributes to understanding of the Lagos megacity's spatial and temporal changes. This will provide an assessment of its spatial patterns, rates of change, trends and the impacts of future changes with GIS and remote sensing. This knowledge will facilitate developing appropriate methods monitoring and managing the changes, which is crucial to the realization of sustainability goals.

Land Use and Land Cover Change Detection Techniques

Land use change detection is a process used in remote sensing to determine changes in land cover properties between different periods to monitor and manage natural resources and urban development by providing quantitative analysis of spatial patterns. Most empirical studies on land use change have depended on the application of remote sensed data and GIS for analysis (Aronoff, 2005; Ademiluyi, Okude, & Akanni, 2008).

Remote sensed data includes land cover information gathered digitally by satellite imagery and aerial photography; they are coded by the using matrix of cells or pixels, which are spatially referenced (Lesschen, Verburg, & Staal, 2005). Several change detection techniques have been identified in literature; the commonly used techniques include principal component analysis (Turan, Kadiogullari, & Gunlu, 2010),

vegetative indices (Muttitanon & Tripathi, 2005), clustering and post-classification comparison (Araya, 2009). A hybrid combining one or more techniques may also be used (Aronoff, 2005).

Data and Methods

In this research, a selection of multispectral and multi temporal images were used for this study; Landsat TM (Thematic Mapper) for 1990 and Landsat ETM+ (Enhanced Thematic Mapper plus) for 2000 and 2011. Adopting a time interval of about ten years as suggested by scholars (Sarvestani, Ibrahim, & Kanaroglou, 2011) and a spatial resolution of 30m, the investigation was carried out using clustering and post classification method. Inability to access Landsat imageries earlier than 1984 limited the study to these temporal periods. Other supporting data used are demographic data of Lagos State obtained from the National Population Census of 1963, 1991, and 2006.

Table 1: Data used and sources

<i>Acquisition Date</i>	<i>Satellite Number</i>	<i>Sensor Type</i>	<i>WRS Path/Row</i>	<i>UTM Zone</i>	<i>Datum</i>	<i>Spatial Resolution (m)</i>
03/01/2011	Landsat 7	ETM+	191/55	31 N	WGS84	28.5-30
06/02/2000	Landsat 7	ETM+	191/55	31 N	WGS84	28.5-30
27/12/1990	Landsat 4	TM	191/55	31 N	WGS84	28.5-30
<i>Supporting Demographic Data</i>						
2006	National Census	Population	Population of Lagos State			
1991	National Census	Population	Population of Lagos State			
1963	Population of Nigeria		Population of Lagos Colony			

The adoption of the best image processing and analysis techniques for information extraction and proper interpretation of remotely sensed images out of several options is dependent on the goal of each project. In this study, ArcGIS 10 Software and TNT Microimages Software were used at different stages for analysis and map production. An unsupervised approach was adopted using remote sensing software classification algorithms known as ISODATA cluster building to facilitate land use change detection.

Table 2: Land Use Land Cover Classification

<i>Level 1</i>	<i>Level 2 (Description)</i>
1. Urban or Built-up Land	Residential, Commercial, Industrial, Institutional, Transportation/Communication/Utilities, Mixed uses
2 Agricultural Land	Cropland, Grazing, Agricultural Tree Crop Plantation, Arable Crop Plantation

3	Forest Land	Riparian Forest, Forest Plantation, Disturbed Forest, Mangrove Forest
4	Wetlands	Forested Freshwater Swamp, Non-Forested Freshwater Swamp
5	Water Bodies	Ocean, Rivers and Streams, Lakes, Bays and Estuaries, Ponds

In order to facilitate land use change detection in this research, five classes of land uses were generated Urban/built-up, Forested Land, Agricultural Lands, Wetlands, and Water Bodies. Level 1 of classes will be used to generate change statistics, while level 2 will be description of classes.

Post classification refinement of hole-filling (using 3 x 3 filters) and accuracy assessment were applied before generating change statistics. Co-occurrence analysis and percentage correct was used for quality assurance and accuracy assessment of the classification. The flow chart in figure 2 above illustrates the steps followed to detect land use change and explicate the peri-urban dynamics of Ikorodu.

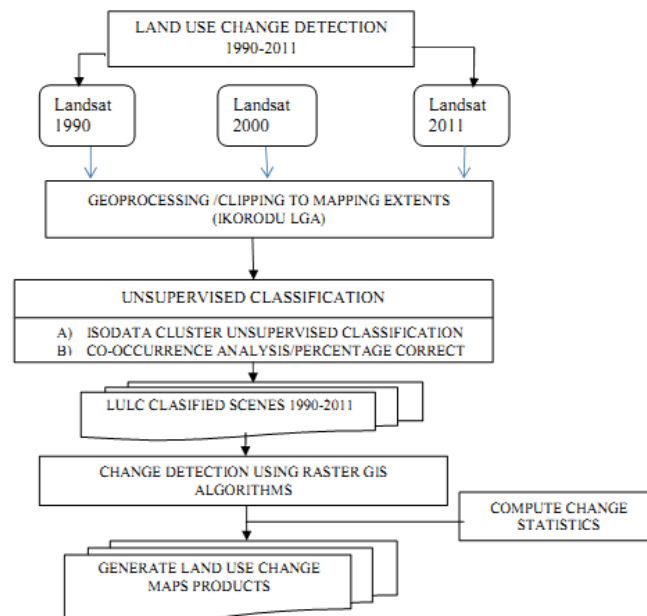


Fig. 2 Change Detection Analysis Workflow Diagram

Result and Discussions

The overall accuracy using percentage correct for 1990, 2000 and 2011 is 62.45%, 91.41% and 88.62% respectively. According to Aronoff (2005), percentage correct is one of the widely used measures of accuracy assessment of classified pixels, which can be used alone without the full error matrix; this was calculated by dividing the sum of the diagonal entries by the total observation. The result of the co-occurrence matrices of pixels classified for 1990, 2000 and 2011 shows the lowest accuracy level was 62.45% (i.e. 1990); this may be because of cloud cover present in the 1990 imagery as seen in figure 3.

The result of the classified land use/cover maps produced for the study area in table 3 and Figure 3 shows a total built-up area of 2320.74 hectares in 1990, this increased to 6116.40 hectares by 2000 and finally 16749.81 in 2011. This represents a 672% growth of built up area in the past two decades, which is three times the population growth that increased from 184,674 to 838,332, i.e., a growth of 237%. On the other hand, there was a consistent loss of forest and agricultural land. 58% of forestland was lost to urban expansion; there was a decrease from 22126.77 hectares in 1990 to 20794.14 by 2000 and further to 15612.66 hectares in 2011.

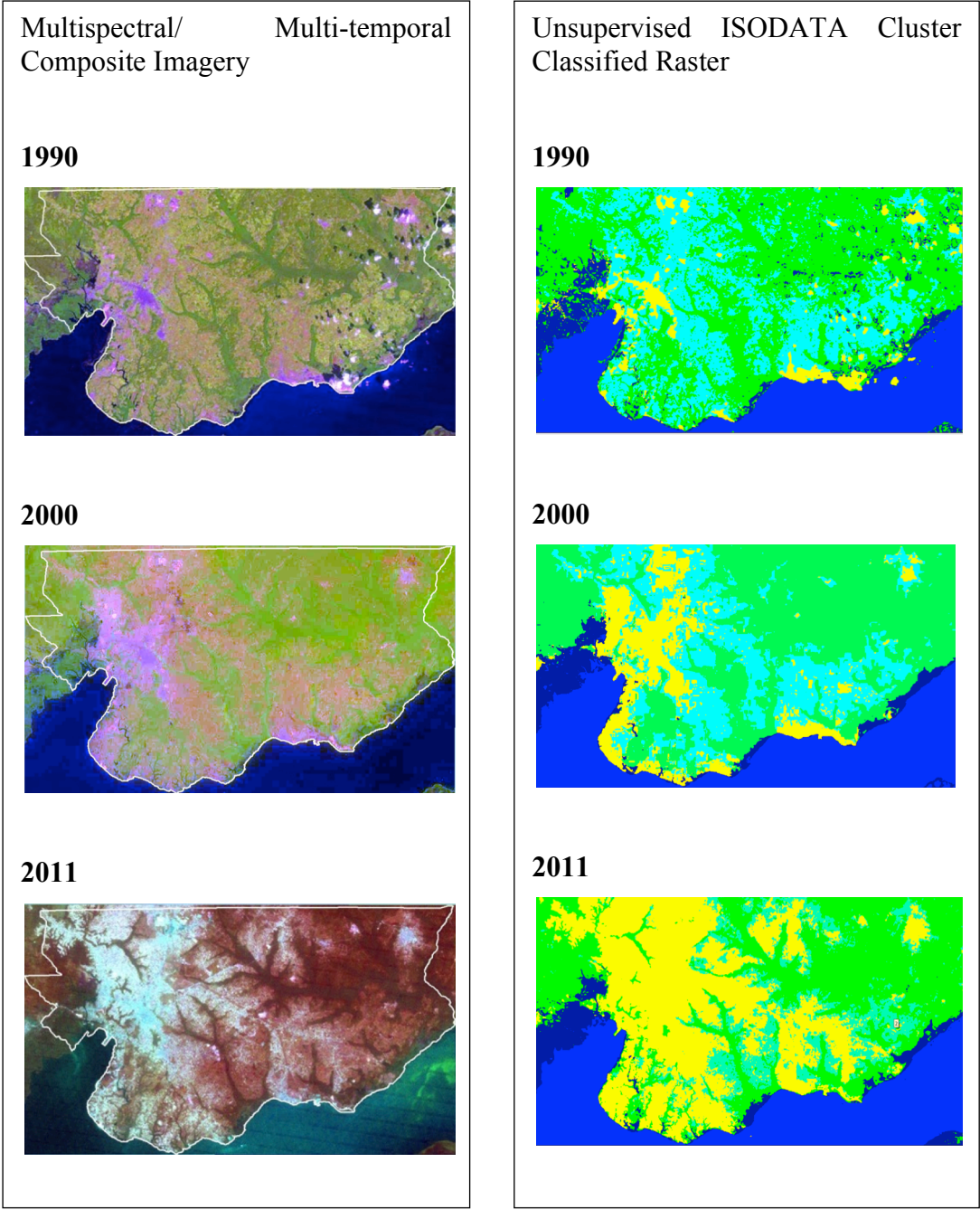


Figure 3: Classified temporal imageries of Ikorodu for 1990, 2000 and 2011.

Table 3: Land Use/Land Cover Change Statistics for Ikorodu (1990-2011)

Land-Use Clusters	1990		2000		2011		1990- 2000	2000- 2011	1990- 2011	1990- 2011 Growth/ Decline
	Area (Ha)	%	Area (Ha)	%	Area (Ha)	%	Change (%)	Change (%)	Change (%)	(%)
Urban/Built-up	2320.74	4.49	6116.40	11.79	16749.81	32.38	+7.30	+20.59	+27.89	+671.74
Agric. Land	13533.48	26.16	10934.91	21.08	5679	10.98	-5.08	-10.10	-15.18	-58.03
Forestland	22126.77	42.77	20794.14	40.08	15612.66	30.18	-2.69	-10.3	-12.59	-29.44
Wetlands	2694.78	5.20	2526.30	4.87	2525.67	4.87	-0.33	0	-0.33	-6.28
Water Bodies	11060.55	21.38	11506.32	22.18	11169.18	21.59	+0.80	-0.59	0.21	+9.82
Total	51736.32	100	51878.07	100	51736.32	100				
Population	184,674		248,529		838,332		34.58	112.42	237.38	
Built-up (m ² /pers)	125.67		246.10		199.80		96	19	59	
Vegetn. (m ² /pers)	2076.90		1378.32		284.10		-34	-79	-86	

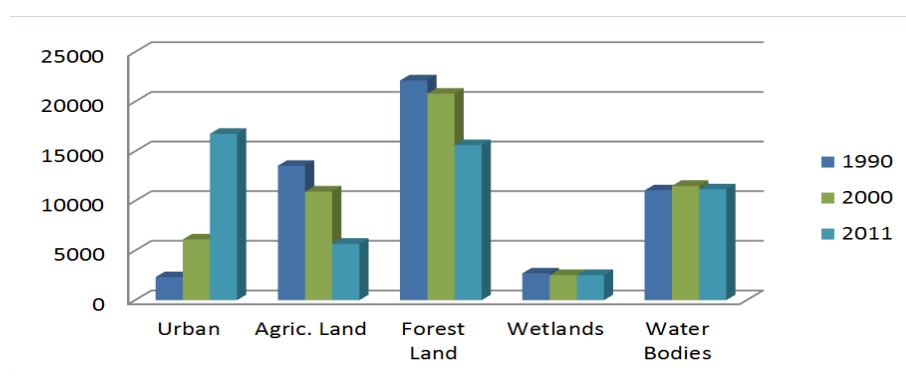


Figure 4: Land Use/Cover Change in Ikorodu 1990-2011

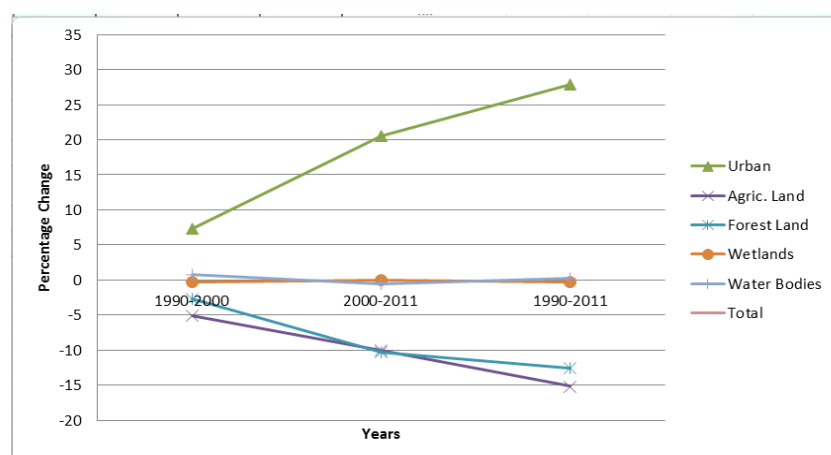


Figure 5: Percentage Change for Ikorodu Land Use/Cover 1990-2011

29% of agricultural land was lost in the past two decades; as seen in table 3, there was a reduction from 13533.48 hectares of agricultural land in 1990 to 5679 hectares by 2011. This phenomenal loss to urban expansion has affected the livelihood of some residents who have been predominantly farmers. Ikorodu as its name implies used to be a vegetable farm, the tradition that is still kept even in the face of urban invasion. Adding the loss of wetlands, this is 6.28%, the total vegetation cover lost to built-up areas for the study period sums up to 94% seen in table 3.

Comparing the rate of change in built-up per capita and vegetation per capita is a simple criteria for evaluating growth patterns (Sarvestani, Ibrahim, & Kanaroglou, 2011); the study also shows that between 1990 and 2000 the built-up per capita index increased by 96% (i.e. 126m² to 246m²), however, this rate dropped by 19% in 2011 as shown in figure 6. The 86% decrease in vegetation per capita from 2076.9 m² in 1990 to 284m² in 2011 is a clear indication of a sprawling development pattern in the study area. The implication of this sprawling pattern is the construction on new sites without any form of planning subdivision and authorization, lack of infrastructure and prevalence of squalors.

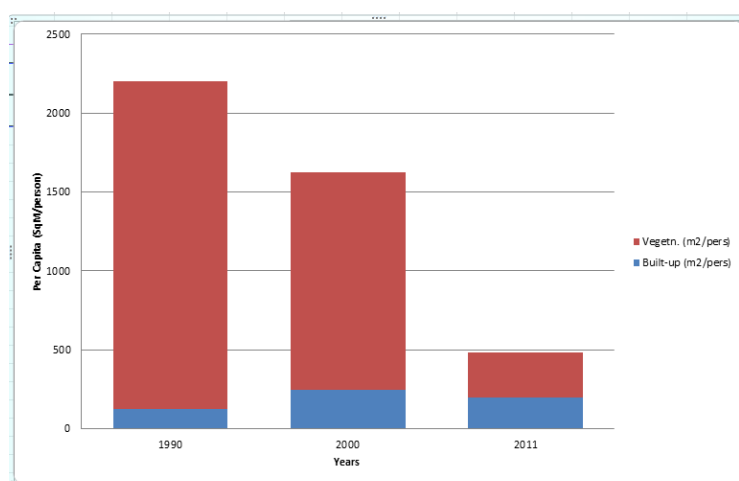


Figure 6: Change in Built-up and Vegetation per capita during 1990-2011

The census figures for Ikorodu divisions of the state between 1963 and 2006 indicates a 186% growth between 1991 and 2006 censuses, this very high when compared to the 44% growth between 1963 and 1991 censuses. The growth could be attributed to increased accessibility due to the dualization of Ikorodu road in the late 1990s. The demographic trends (table 4) reveal that the population growth in peri-urban areas of the Lagos megacity likely due to intra-regional migration than birth rates. The rising land prices in the city centre have caused many middle and low-income earners to migrate to peri-urban areas and fringes, where cheaper land is available.

A cursory look at the census and land use change data of area under investigation shows a rapid urban transition in peri-urban areas of the megacity. In the Lagos Metropolitan master plan prepared in the 1970s, most towns in Ikeja division were classified as rural and urban fringe of the Metropolitan Lagos. Agege, Ikotun, Igando, Iju-Ishaga, Abule-Egba were predominantly rural, while Shomolu, Bariga, Ifako, Gbagada, Ilupeju, Palmgrove, Maryland were the peri-urban areas. However, due to

population growth of about 671% as seen in table 4, these areas have experienced transition from sub-urban and rural to urban status by 1991. During this same period, peri-urban towns that experience similar population explosion and rapid urbanization in Badagry Division include Ajegunle, Olodi-Apapa, Orile-Iganmu, Amuwo, Ojo, Iba, etc. A spatial planning framework must be put in place to prevent the uncontrolled and unplanned urban expansion witnessed in the sprawling development in Ikorodu town.

Table 4: Census Data for Lagos State Administrative Division (1963-2006)

<i>Divisions</i>	<i>Current Status</i>	<i>Census-1963</i>	<i>Census-1991</i>	<i>Census-2006</i>	<i>1963-1991 Intercensal growth (%)</i>	<i>1991-2006 Intercensal growth (%)</i>
<i>Lagos Division</i>	<i>Urban</i>	<i>675,681</i>	<i>1,213,200</i>	<i>1,549,042</i>	<i>80</i>	<i>28</i>
<i>Ikeja Division</i>	<i>Urban</i>	<i>394,972</i>	<i>3,046,353</i>	<i>4,873,924</i>	<i>671</i>	<i>60</i>
<i>Badagry Division</i>	<i>Semi-Urban</i>	<i>122,159</i>	<i>1,154,488</i>	<i>1,863,195</i>	<i>845</i>	<i>61</i>
<i>Ikorodu Division</i>	<i>Semi-Urban</i>	<i>128,119</i>	<i>184,674</i>	<i>527,917</i>	<i>44</i>	<i>186</i>
<i>Epe Division</i>	<i>Semi-Urban</i>	<i>122,638</i>	<i>126,401</i>	<i>299,527</i>	<i>3</i>	<i>137</i>
<i>Total Lagos State</i>		<i>1,443,569</i>	<i>5,725,116</i>	<i>9,113,605</i>	<i>297</i>	<i>59</i>

Conclusion and Further Research

The study so far examined the land use/cover change and urban growth of Ikorodu, one of the most important and fastest growing peri-urban municipalities in the Lagos megacity. Taking a retrospect into the Lagos Metropolitan Area Master Plan (1980-2000), it was proposed that Ikorodu should serve as a counter magnet absorbing a significant portion of the megacity's population. However, there has never been a comprehensive plan to guide development in Ikorodu until now. This explains the sprawling fractal that has been created. This calls for urgent preparation and implementation of the Ikorodu Master Plan.

Land use change is a major challenge inhibiting sustainability at global, national and local scales. Urban dynamics and its consequential persistent loss of forest and agricultural resources environmental in peri-urban areas of large cities like Lagos, which is usually unnoticed due to lack of spatial technologies and infrastructures that are adequately integrated in our land-use planning framework must be addressed to prevent a trend leading to a mega-slum and ecocide.

A critical appraisal of land use planning laws of the Lagos State Government also shows that there is a slant towards physical development with lesser emphasis on sustainability and the environmental implication of planning decisions and actions. The concept of environmental impact assessment is not holistic, but 'paying the piper and dictating the tune'. There is therefore the need to reinforce spatial planning through the created regional planning agencies.

On methodological grounds, the research has been able to reinforce the premium that should be placed on remote sensing and GIS skills in urban planning agencies in order to effectively analyze and monitor the urban dynamics of fast growing cities. This is realizable by a shift in our paradigm of GIS in planning education from objectivism to

constructivism. This implies that planning schools should teach with GIS and not about GIS.

With regards to further research, this paper is part of an ongoing research at the University of Lagos. The research will further investigate other administrative divisions of Lagos State to determine spatial variations in land use change and their determinants. Spatial model will be used to predict future scenarios. It is hoped that the research will significantly help in understanding the peri-urbanization process of the Lagos Megacity.

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Involvement of People in the Design of Community Building in Developing Countries

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Abstract

Although the public participation concept, or techniques to enhance and /or influence decision making is a fact of life for many governments nowadays and has been used by many industries to improve their products and increase end-user satisfaction, it is still new to the Architectural, Engineering and Construction (AEC) industry. The extent to which participation should occur and the role that it plays remains uncertain in the AEC industry. For many researchers, participation has been the predominant conception for a long time. In practice, this has meant that public participation has often occurred late in the planning process. This research focuses on the involvement of people in the design process of community buildings in developing countries. In Libya for instance, many community buildings were built during the last five decade; unfortunately, a number of these did not perform as well as planned. Many of these problems were related to design, hence the choice of architectural design of these buildings for this research. If people had been involved in the planning and design stages, it is argued that a significant portion of these problems would not have occurred. Thus, the aim of this research is to develop a conceptual framework to involve the public, in developing countries, in the design of community buildings. A thorough review of previous work related to the public participation in the design of community buildings has been conducted as part of this research. The review has revealed that most of the studies in this area were done on developed countries and that, so far, no research has been conducted on developing countries.

Keywords

Buildings, Community, Design, Involvement, People, Participation.

Introduction

Rachel (2008) defines involvement as a way of genuinely and actively engaging people in the decision making of public bodies. Participation has been the predominant conception for many years, with many researchers (Smith, 1982; Guijt, 2007). However, the main emphasis has been on direct involvement of end-users affected by proposals, especially through the use of public hearings. In practice, this has meant that public participation has often occurred late in the planning process, as well as most public participation occurring at the operational level of planning (Smith, 1982).

Damodaran (1996) states that effective user involvement in system design does indeed 'inevitably bring in wider elements of working life'. This phenomenon occurs because

many decisions, which apparently focus upon purely technical issues, are in fact socio-technical in nature.

A hierarchy of planning involves normative, strategic and operational elements. Involvement is a means of participation or engaging people in the decision making of public bodies. Its purpose is to permit public authorities to meet with people to make decisions. In addition, the purpose of involvement is to collect views and experiences from people, so that these are taken into consideration during the design stages. Therefore, the designer should be open-minded both to old and new ideas, in order to achieve a good blend of ideas (Woolner et al, 2005).

In developing countries, community buildings have major problems; some of these can be related to the design of these buildings and to the lack of considering the needs of the public in their design. In Libya, for instance, during the last five decades a number of community buildings have been built, including hospitals and schools, that suffer from many problems. Amongst these are lack of facilities for disabled people, due to the fact that the authorities did not listen to people's views on the design process, even in line with requirements to do so (Hirschheim, 1983). Furthermore, there are several problems around proper design, for instance the choice of the site for the design of a community building. Therefore, the involvement of people in designing community buildings in developing countries is very important

Since schools are very common in Libya, this paper will focus on the design of secondary schools and show how end-user involvement can be part of the design process stage, in order to take advantage of knowledge about this topic and to propose radical solutions appropriate for children.

This paper presents a research project that is investigating public participation in the design of community buildings in developed countries, to understand how end-users of community buildings are involved in these buildings, especially secondary schools. The paper is divided into four main parts: the aim and objectives of the research; the methodology; the involvement of end-users in the design process stage and identifying some of the problems; and the previous work carried out in this area and specifying some of the problems that have not yet been reviewed. The last section includes the conclusions and future work.

Aim and Objectives

Academic research has paid great attention to involving the general public in the design process in many industries and many fields. However, public participation in designing community buildings has not yet been fully discussed in the Libyan context. The question of how to involve the public in the design process is still under investigation by academic researchers. Many problems in existing community buildings are strongly related to the lack of consideration of public needs at the design stage. Furthermore, previous research has paid scant attention to the increased involvement of the general public in the design of community buildings (secondary schools) in developing countries. This new research aims to develop a conceptual framework for involving the general public in the design of community buildings in developing countries. To achieve this aim, the following objectives are formulated:

- critically review the extent of literature concerning the evolution of the architectural design process in the last five decades in developing countries, and especially in Libya.

- investigate existing design problems in community buildings (secondary schools)
- critically review and discuss existing approaches and frameworks of end-user involvement in the design of community buildings
- determine the requirements of a new conceptual framework that designers will use to involve end-users in the design process
- develop a conceptual framework for involving people in the design of community buildings in developing countries
- test and evaluate the proposed conceptual framework

Research Methodology Approach

The main aim of this research is to involve end-users (staff and visitors) in the design stage to fulfil their needs, especially in community buildings. This paper presents the work needed to achieve the first objective of the research study. Therefore the research method adapted is literature survey of previous related works on involvement of people and end-users of community buildings in the design stage. This includes a review of the concept of people participation in decision making, the design process during the last five decades in developing countries and especially in Libya.

Public Participation in Decision Making

The public participation concept or technique, to enhance and/or influence decision making, is a fact of life for many governments today and has been used by many industries, but it is still new to the Architectural, Engineering and Construction (AEC) industry. The extent to which participation should occur and the role that it still plays remains uncertain in the AEC industry (Campbell and Mattila 2003).

There is ample evidence to suggest that end-users need to be well informed and to have real understanding of the principles underlying the processes in which their active involvement is sought (Damodaran, 1996). Mechanistic following of prescribed procedures, without an understanding of the intended goals of the whole process (users), is likely to prove futile at best and probably expensive and wasteful as well (*ibid*). The strategy must also include a clear allocation of responsibilities to key stakeholders and clarity regarding the respective roles of the different players in the design of community buildings.

The wider participation of end-users in the design process ensures that designers have access to user knowledge and experience; but their participation should also set up close relationships between end-users and designers providing the collaboration is long enough and valued sufficiently. This reasoning has underpinned the development of participatory planning.

Framework for People's Participation in Design of Buildings

The best known attempt to determine the scale of participation by the public is through what Arnstein (1969) conceptualised. She sees the citizen participation of citizens as an empowerment term citizen "the redistribution of power that enables the have not citizens, presently excluded from the political and economic processes, to be deliberately included in the future" (Arnstein 1969: 351). Effort has been made to

encapsulate her participation of citizen's ladder in Gradient Post and in various programs of the federal government of the United States, such as urban renewal, anti-poverty and model cities; although she said that it has a clear extension to other areas (citizen control, delegated partnership, placation, consultation, informing, therapy and manipulation).

There are many different ways to clarify the process of designing a product or environment-named design patterns. "Design models are representations of philosophies or strategies proposed to show how the design is and may be done" (Evbuomwan et al, 1996: 305). Each model has a design stage of its own and is part of the product life cycle or the environment.

Members of the users' group Eindhoven (Marking et al, 1997, cited in Demirbilek, 1999) developed a framework called "user-based design (?) and development model", for ease of use and design. This framework uses existing human factors, principles, regulations, materials and standard practice, and any other relevant information. The objective of this proposed framework (User-Based Design and Development Model) is to find out whether or not the working framework/prototype achieves the required tasks at a desirable level of usability, by testing chosen hypotheses defined at the concept-testing stage and by testing the outcomes of technology development. Verification of usability against success criteria is made by means of quantified report evaluation (Demirbilek, 1999).

The current models of community participation, such as Arnstein's ladder of citizen participation, although adequate for analysis in developed countries, provide misleading results within a development context (Choguill, 1996).

Design Process

There is a wide range of knowledge that deals with the design process, whether in the field of construction or, as is more general, in the engineering disciplines. The different frameworks that have been developed describe the design process in general and provide an overview of the classical theory frameworks of the design process, such as Darke, Lawson, March, Pahl and Beitz, Pugh and Cross in Birmingham and others (Birmingham et al. 1997). Recent contributions continue to expand this knowledge base, for example, human factors, and design to participate, which focuses on user design and design-centred (Keinonen, 2009) or development of information systems that project design support (Hartmann et al, 2009) and (Moum et al, 2009). In this context, this section focuses on the emergence of the information design of the building during the building design process, and how this information can then be used to generate more information about the performance of the design and direct more of the steps in the design process.

Koskela et al. (2002) point out that there are three perspectives to view design: transformation, flow and value generation. The concept is based on the transformation to convert the design requirements according to the design specifications. Considering exclusion of the time and customers, which represents the traditional approach, as is the case in stages, for example, RIBA design stages. From another point of view, a process and information flow and methods are applied in concurrent engineering, for example set menu design. According to reports by Parrish et al. (2007) and (2008), set based design is an application of dividing the design process into conceptual design and detail design that is useful for building design. Pektas and Pultar (2006) use the

perspective of the flow of information in the design of repeated cycles of information management to manage the process. Previous efforts involving generation and providing value in building were discussed by Rutten et al. (1998). He connects the area through jobs value to the design domain

Conceptual Design

The focus during the conceptual design is on integrated design data collection and characterising the early stages of design, because of the need to evaluate a large number of statuses and different levels of design abstraction with but little design information. Moreover, there is usually a lack of knowledge about the interaction between the design variables and subsystems (Matthews, 2008). These are usually structured engineering design problems, which prevent a clear definition of space option (Stouffs, 2008). An issue was that no one asked a number of design representation questions, also called concepts, for determining the area of choice.

In fact, the problem is addressed with a logic design based case (Mora et al, 2008). Designers were to reuse experience gathered in previous design projects. Thus the quality of the resulting design solution would be directly affected by the extent of professional experience. (Stouffs, 2008) states that this represents the advanced design of both the means and products. Means, and the problem of design changes and evolve during the process of defining and products, because they represent solutions to design problems identified earlier.

Design of Schools

Many writers have argued that during the nineteenth-century influx of school buildings, architects were more concerned with society's general aims and ideals for mass education than with specifics of teaching or educational practice (e.g. Dudek, 2000 and Woolner, 2009). This gave students a sense of satisfaction, because the design of the schools was so pleasant and attractive to the students that it made their experience with the educational system more satisfying. Seaborne and Lowe (1977:4) support this idea, stating that "the view was widely held, although less often articulated, that the school building should contribute to the aesthetic sensibility of the child by showing him standards beyond those of his home". However, Robson (1911) argues that architects usually see schools as one of the easiest buildings to plan and design, and that much difficulty arises from the fact that architects will not take the trouble to understand the educational side of the case. Robson and many others during the twentieth century were more concerned with the detail of the relationship of their buildings to the educational activities that took place within the building they had designed and built. Yet this relationship between educational ideas and practice was, overall, not conceived as involving engagement with the teachers and learners themselves. For example, during the 1930s, the award-winning school architect Denis Clarke Hall based school designs on observations of school users, but did not really seem to have taken into consideration their interpretations or understandings of the processes they were involved in (Maclure, 1985).

End-user Participation in Design in Developed Countries

In the beginning of the 1960s, architecture started to gain more momentum and became more influential in Europe and the USA. Some of the architects working in these fields have specifically argued that differences between lay and expert opinions

about architecture mean that it is necessary to involve ordinary users in any design process (Flutter, 2006). For example, within the past few years the architectural education system in the UK has shown great enthusiasm for democratisation, in particular through more active involvement of learners. This is a clear example that shows how the participation of end-users is practically evidenced in UK schools at both local and national level, and is the key element to current theorising and research about education (Clark, 2004). Researchers working with community building users, such as students, see school design as another area where students should be involved in making decisions about their school environment (Frost and Holden, 2008). The following quote supports this idea: "Issues about the environment are also a relatively comfortable topic for teachers to explore with students whereas inviting students to comment on teaching can be difficult for both teachers and students, where within design and architecture, it seems self-evident that planners and architects designing and building would benefit from considering in some detail, the purpose and intended use of the space. This leads to the idea that some involvement of the potential users in the design process should lead to more appropriate, closer fitting premises" (Flutter, 2006:183-194).

The UK government will endeavour to refurbish, develop and enhance every secondary school in England and Wales over the next ten to fifteen years. The development and enhancement of these schools requires proper design and will be achieved by continuous end-user involvement. A very important part of the BSF scheme was "proper consultation with the staff and pupils of the school and the wider community" (DfES, 2002: 63). But recent research suggests that there is no ideal educational environment. Other research also suggests that whether a refurbishment or a rebuild will be successful depends heavily and critically on the level of adequacy of the old premises (Woolner et al., 2007a; PricewaterhouseCoopers, 2007: 16). So it is important to fit the building to the needs of the users and to develop a sense of ownership, both of which may be achieved through a hands-on design process.

During the post-second world war period of school-building, collaborations between architects and educationalists really developed well, taking off during the 1940s and 1950s, becoming properly embedded by the 1960s school-building boom. Partnerships between designers and end-users during these times produced innovative schools, including the first open-plan primary schools, within tight physical constraints, which seemed to satisfy both pedagogic needs and aesthetic ideals (Saint, 1987; Maclure, 1985). Architects usually tended to concentrate on the educational understanding of advisors and head teachers. The experience of ordinary teachers and other staff, together with the ideas of students and parents, was overlooked, making it more difficult for the designer to appreciate the school's learning environment. Designers and architects can come to understand the range of views held within the school community by teachers, students and other members of staff; this would definitely increase the chances of satisfying more people's needs. However, there is a danger that this kind of attention to the perceptions of a school community, which is only familiar with their current situation, might lead to the diluting of ideals and possibly a failure to understand the potential for change. However, it still seems reasonable to conclude that when designers and architects become familiar with the range of views held across a school community, it is more likely that the resulting environment will be fit for all the purposes anticipated or desired. That is the ultimate aim of all designers and builders.

Benefits of User Involvement

User involvement is a widely accepted principle in the development of community buildings (Kujala, 2003). However, it is a vague concept covering many approaches. This study focuses on the nature of user involvement and its expected benefits, and secondly, reviews three streams of research. The study then goes on to evaluate the benefits and problems of varied user involvement approaches in practice. The particular focus of this study is on the early activities in the development process. In reviewing this literature, a suggestion that user involvement has generally positive effects, especially on user satisfaction, is clear. There is also some evidence to suggest that taking users as a primary information source is an effective means of requirements capture. However, the role of users must be carefully considered and more cost-efficient practices are needed for gathering users' implicit needs and requirements in real product development contexts. (Kujala, 2003).

For this study, “community building” means a building which is managed or run for a public benefit and that plays host to the activities of a range of users; hotels, hospitals, mosques and schools would fit into this category.

Several studies (e.g. Robey and Farrow, 1982) show that effective involvement of end-users in the design process will benefit the community by:

1. Improving quality of the design arising from more accurate user requirements.
2. Avoiding costly design features that the user did not want or cannot use.
3. Improving levels of acceptance of the design.
4. Greater understanding of the design by the user (resulting in more effective use).
5. Increasing participation in decision making in the organisation.

Conclusions and Future Work

From the literature review carried out so far, little work has been undertaken in Libya regarding the involvement of people in the design of community buildings - especially school design. This subject will be very important in future for Libya, because it is one that has not been scrutinised before. This research proposal, therefore, will be the first of its kind and will inform future policies of the Libyan government on aspects of user involvement in the design of community building. The methodology applied in this study would benefit similar studies in countries where user involvement in design of community buildings hasn't yet been considered.

One of the most important expected outcomes that will likely be generated from conducting this research is a novel framework that can be used in the design process. This framework comes from collecting data from variety of sources, i.e. literature survey, interviews and questionnaires. This framework will benefit the end-users, designers and decision makers of community buildings in Libya. First it will benefit architects who design school buildings to achieve more reliable and friendly environments for students. Second it will benefit the end-users themselves; namely students, parents, teachers, visitors, etc. Third it will benefit the government on cutting costs on failed projects.

The future work will be conducting the following tasks to achieve the remaining objectives of this research study listed above:

- Questionnaire survey, to investigate and identify the problems in the design of community buildings (e.g. psychological, social, cultural, aesthetic performance; efficiency and work flow performance, accessibility, privacy, etc.)
- Interview survey will be conducted with designers and decision makers involved in the design of community buildings, to review existing use of frameworks and models of end-user involvement in community buildings design, and any problems with their use, if used. If not, why there was no adoption of such frameworks or models for involvement of people in the design of community buildings in the county of study.
- IDEF0 (a functional modelling method) to developing a conceptual framework for involving people in the design of community building in developing countries and evaluating the evolution of the architectural design process to date for developing countries and validation
- Focus group research method will be used to test and evaluate the proposed conceptual framework.

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An Analysis of Spatial Planning Strategies in Reducing Automobile Dependent-related CO₂ emissions and related co-benefits in cities – Case of Abuja, Nigeria

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Abstract

The unprecedented level of automobile proliferation in cities has created phenomenal challenges of soaring CO₂ emissions footprint and traffic congestion snarls. Empirical evidences have attributed this quagmire to the deficit of the existing urban planning system in cities which lay the city on its back and increase the distance between core-city employment areas and suburban residential areas. Consequently, there has been increasing recognition of the need for a shift away from the present dysfunctional overly extensive spatial form and mobility pattern. More worrisome is that in the resulting automobile dependent scenario, transport sector investments are largely skewed towards permitting private automobile ownership and use at the expense of public transportation especially in cities in the Global South region.

This study illustrate the application of spatial planning strategies as Bus Rapid Transit (BRT), Transit Oriented Development (TOD) and congestion pricing as being capable of de-leveraging transport-related CO₂ emissions and traffic congestion challenges of man-hour and fuel wastages on the Kubwa-Bwari route in Abuja. The findings here create the imperatives to institutionalize spatial planning so that the urban planning system in Abuja can efficiently respond to the challenges of suburbanization and automobile dependence, and retrofit transport related carbon emission footprints.

Keywords

Spatial planning, automobile dependence, CO₂ emissions, Transit Oriented Development (TOD), Bus Rapid Transit (BRT), Congestion Pricing

1. Introduction

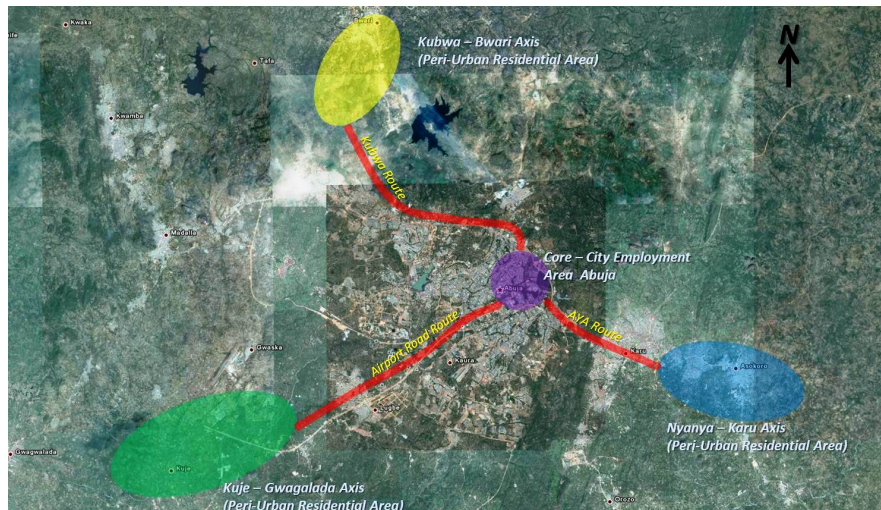
Undoubtedly, it has become increasingly evident that the two ferocious forces inhibiting sustainability of cities globally are *urbanization* and *climate change*. These phenomenons have emerged as transformative stressors compelling institutional change across cities. Globally, urbanization has continued to create agglomeration in cities with implicit increasing ecological and carbon footprint from the huge consumerism pattern. This consumption pattern is expressed in several ways, these include the increasing demand for mobility as a result of increasing income level, and importantly because mobility is a critical enabler of economic development. Consequently, this demand for mobility has overwhelmed most cities and has permitted automobile-dependent mobility pattern with related consequences as CO₂ emissions and traffic congestion challenges of man-hour and fuel wastages (Al-Mofleh et al. 2010, p. 449, World Bank Sustainable Transportation Priorities for

Policy Reform and Development in Practices Series 1998 cited in Molina et al., 2004, p.5, Schipper and Marie-Lilliu 1999, p.1, Schipper et al. 2000, p. 9, Schipper and Fulton 2002, p. 44, Dhakal and Schipper 2005, p. 12 and Penalosa 2004, p. 1).

More worrisome is that the phenomenal growing trend of suburbanization, demand for mobility and the growth of automobile dependence closely mimic the trend of urbanization. Therefore, it is feared that these trend will not only leverage cities' transport-related carbon footprint, but also culminate into dysfunctional mobility pattern. Empirical evidences have illustrated that the creation of smart, compact, and richly diverse TOD communities is key to deleveraging car use and stem the trend of suburbanization (Calthorpe 1993; Beimborn and Rabinowitz 1991, Cervero 1997; Williams, Burton and Jenks 2000 cited in Kenworthy 2006 p. 70, Williams et al 2000, Breheny 1995, Rickaby 1987, Feitelson and Verhoef, 2001 cited in Williams, 2005, p. 2). Evidently, with richly diverse TODs in a transit-dependent mobility pattern, the transit ridership so generated would optimize transit operation. This will remarkably reduce car use by resident by about 50% and household savings up to about 20% as desire for private automobile use dwindles (William 2005, p. 3, Cervero, 2008 cited in UNHSP, 2009 p. 125, Hickman and Bannister 2005, p. 102f). Thus, spatial form of cities is pertinent to the shaping and transformation of the transportation pattern in cities, in that, it has the capability to dwarf the level of private automobile ownership and use. Therefore, there is the dire need to rethink the spatial configurations of cities towards richly diverse TODs so that the challenges of automobile dependent mobility are retrofitted, and to achieve sustainable low carbon transport system.

The phenomenal rate of urbanization in Abuja is put at 9.3% (UNFPA, 2011) and predicted to continue for the next 15 years, and with prevailing Classical Modernist Planning (CMP) system, agglomeration and suburbanization have grown phenomenally. In addition the implicit *predict and provide engineering solution* to transportation challenges has permitted building and expansion of highways as exemplified in North American cities (Williams, 2005, p. 2, Chin, 2002, p. 10), rather than huge investment in public transportation exemplified in Curitiba-Brazil, Bogota-Columbia and Rotterdam-the Netherlands. This prevailing character of engineering solution in Abuja has increasingly created enabling environment for the growth of suburban areas of Nyanya-Karu, Kubwa-Bwari and Kuje-Gwagwalada axes, and this has permitted automobile dependence with less investment in public transportation. As a result, daily motorized trips are high and take place majorly via private automobile and fragmented, un-reliable polluting mini-buses. This strongly contributes to CO₂ emissions, traffic congestion and related challenges of man-hour and fuel wastages.

This study centres on the analysis of spatial planning strategy as tool for transforming the existing Classical Modernist Planning (CMP) system in Abuja and the implicit transport related CO₂ emissions and traffic congestion challenges stemming from the huge automobile-dependent mobility pattern. With focus on the commuting volume via private automobile and mini-buses between the suburban residential area of Kubwa-Bwari axis along the Kubwa-Bwari Route, and the core-city employment area of Abuja (See Figure 1).



Source: Google Earth, 2012.

Figure 1: Commuting Pattern between the Core-city and Peri-urban areas of Abuja

1.1 Study Area

With its inception in 1976, Abuja assumes the status of the new administrative capital of Nigeria. As the seat of the National Government, Abuja is serving as a nexus which propel continued growing agglomeration. Abuja is located between latitude $8^{\circ} 25''$ and $9^{\circ} 25''$ North of the Equator, and between longitude $6^{\circ} 45''$ and $7^{\circ} 45''$ East of the Greenwich. It is bordered to the North by Kaduna state, to the East by Nassarawa state, to the south by Kogi state and to the west by Niger state. It is also situated at the geographic centre of Nigeria with approximately 800km from all corners of the country (Figure 2 and 3).

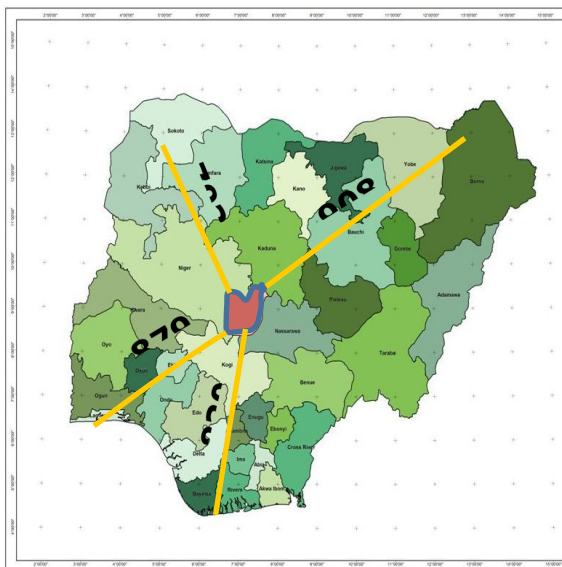


Figure 2: Abuja in the National Context
Source: Abuja Geographic Information Systems (AGIS) (2011).

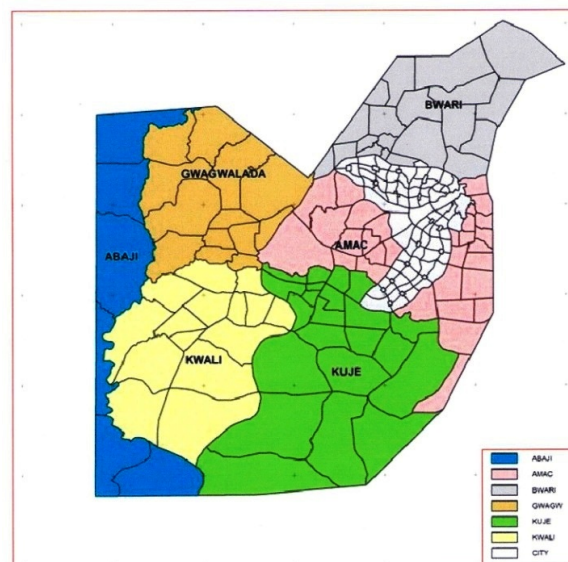


Figure 3. The Core-city Abuja and the Area Councils Source: Abuja Geographic Information Systems (AGIS) (2011).

Abuja-The Federal Capital Territory (FCT) is growing rapidly with infrastructural development (Roads and Highways, Sewers, Water and Electricity) with huge concentration of investments in the core-city of Abuja (the Federal Capital City-FCC) at the expense of the suburban areas located in the area councils. The core-city of Abuja (Federal Capital City-FCC) is located on the northeastern part of the entire Federal Capital Territory (FCT) with the territory divided into six (6) area councils (See Figure 3) (FCDA, 1979, p. 2-5).

2. Methodology

The study is premised on both Primary and Secondary data. The Primary data were acquired from direct personal observation, photo recording, and interview sessions with transport user groups (commuters and drivers), transport owner groups: National Union of Road Transport Workers Nig. Ltd. (NURTW), Abuja Urban Mass Transport Company Ltd. (AUMTCO), and Self-Employed Commercial Drivers Association Nig. Ltd. (SECDA); Practitioners in Federal Capital Development Authority (FCDA) Urban Planning Department, Satellite Towns Development Agency (STDA) Planning and Housing Divisions, FCT Transport Secretariat, FCT Directorate for Road Traffic Services (DRTS), The Infrastructure Bank, and Federal Ministry of Environment. The total number of interviews conducted equals 21.

Primary data from Author's field survey of passenger and vehicle traffic volume on the Kubwa-Bwari route was also analysed in line with the secondary data of similar survey conducted by the FCT Transport Secretariat to compute present and project future scenarios of CO₂ emissions and traffic congestion challenges. Secondary data were also collected from FCDA Urban planning as related to the character/capacity of the existing CMP system to respond to growing urbanization and suburbanization in Abuja, imagery analysis to show the growing rate of suburbanization and expenditure on building and expansion of roads.

The analysis of the data was done to explain the CMP paradigm which permit growing suburbanization, and the predict and provide engineering solution of building and expansion of roads. The analysis is also focus on the resultant automobile dependent mobility and the inherent consequences on CO₂ emissions and traffic congestion challenges (man-hour and fuel wastages) and the deficit in the CMP character in addressing climate change and sustainable development. The analysis also evaluated the view of Practitioners, Transport Users and Transport Owners groups in the application of spatial planning strategies to retrofit and address these challenges.

2.1 CO₂ emission measuring methodology

In order to understand the CO₂ emission levels from automobile, the study of Mickunaitis et al., (2007, p. 160) was considered, it illustrate that when fuel is burnt by automobile combustion, one litre of diesel fuel releases 2.7kg of CO₂, while one litre of petrol produces 2.4kg of CO₂. An aggregate of the findings of these studies is indicative that increase in fuel consumption increases the level of CO₂ emission, thus increasing demand in mobility in automobile-dependent extensive urban spatial configuration with higher Vehicle Kilometre Travelled (VKT) will increase the level of CO₂ emission.

3 The permissive factors to increasing automobile dependence in cities

Unequivocally, the present unprecedented level of automobile usage in cities has been described as unsustainable due to its inherent challenges of CO₂ emission, congestion, and particulate matter air pollution. Increasingly, this existing quagmire has been linked to the existing planning system in cities which is premised upon the Classical Modernist Planning paradigm (Master Plan). This paradigm is characterized by the “*Predict and Provide*” engineering solution of road building and expansion, low-density development, dispersed urban forms, expert-driven technocratic activities, single-use areas, and rigid standards/ regulations. More worrisome is that this paradigm has permitted sprawl and suburbanization which has continually increased the distance between suburban areas and the core-city. The abysmal level of investments in public transportation has continually skew mobility towards private automobile ownership and use. This mobility pattern has continually overwhelmed road ways by traffic snarls, and heightens transportation-related CO₂ emissions and traffic congestion challenges of man-hour and fuel wastages.

Empirical evidences have illustrated that in cities where the CMP system is pursued, the implicit *predict and provide engineering solution*, permit the continuous building and expansion of roads to address transportation challenges, and this fuels the trend of sprawl/suburbanization (UNHSP, 2009, p. 154, Salingaros 2006, p. 1). Unarguably, evidences have illustrated that traffic do not behave like liquid that retain its volume in a given space, but rather like gas that expand over any given space so provided (Litman 1998 cited in Newman and Kenworthy 2000 p. 23, ITDP and EMBARQ, 2012, p. 5). At best, this engineering solution of building and expansion of roads largely induces more traffic and soon after the expansion phase the traffic challenges that ensue depict as though no improvements were made earlier. In Newman and Kenworthy’s (2000, p. 23) summary, automobile dependence is inevitable in this unsustainable scenario of traffic engineering, and that, at best, it sets in motion vicious circle of self-fulfilling prophecy of congestion and more road building.

Incidentally, cities in the global south region have remained plagued by these challenges because these form of planning spread to all corners of the world in the 20th century through the processes of *colonialism, market expansion, international planning consultancies and intellectual exchange of planning values peculiar to solving the challenges of European cities*. These factors explain the influences and diffusion of Classical Modernist planning ideas to most of Sub-Saharan Africa. Many master plans and zoning schemes in Nigerian cities and Abuja today maintain the traditional landuse planning devoid of density and functional mixes, and emphasize single-use zoning, permissive mobility of building and expansion of roads (Okon 2008, p. 2 and Ball 2012). Planning Laws and Zoning Ordinances, in many cases today is exact replica of those in Europe and UK in the early 20th century and is still enforced as under colonial autocratic rules.

Abuja, the New Federal Capital of Nigeria was consciously planned with a master plan as blue print for the city’s development. However, because of the implicit CMP character, Abuja is today gradually being faced with dysfunctional transportation system characterized by the challenges of automobile proliferation and related externalities of CO₂ emission, traffic congestion and related challenges of man-hour and fuel wastages.

4 The role of Spatial Planning Strategies in reducing transport-related CO₂ emissions in cities

Globally, the need to mainstream sustainable development agenda into urban planning and spatial development has necessitated the quest for new urban planning paradigm. The character of the Spatial planning that is outcome-focused, and avoid narrow, exclusive and disjointed practices demonstrate the character of the required paradigm for addressing the complex realities and challenges in cities. The spatial planning paradigm goes beyond traditional landuse planning, allows for situation-specific broad range approaches, which are capable of addressing the challenges created in cities globally as a result of international borrowings of the “*off- the-shelf*” CMP system (RTPI 2007, p.47, Nadin 2006, p. 17f). The strength of spatial planning include the “coordination or integration of the spatial dimension of sectoral policies through a territorial based strategy” by establishing better coordination on territorial impacts “horizontally across different sectors, vertically among different levels of jurisdiction, and geographically across administrative boundaries” (Cullingworth and Nadin 2006 cited in RTPI 2007, p.9, RTPI 2007, p.11).

Evidently, spatial planning has the requisite capacity to change urban planning from the existing quagmire of restrictive bureaucratic exercise that constraints development, to a more pro-development scenario where urban planning system will be proactive rather than reactive. Evidently, the adoption of spatial planning is known to guarantee the realization of integrated strategic solution as viable TOD, integrated public transportation (Hoornweg et al. 2011, p. 3 and 12) as BRT and implementing Congestion pricing. This integration is known to have produced remarkable results in deleveraging the sustainability challenges of CO₂ emissions, traffic congestion implicit to automobile-centered mobility pattern in cities and also serves as viable climate change action at the urban level (Rydin, 2011, p.33, UNHSP, 2011).

The city centre planning in Sheffield, Curitiba, Bogota, Guangzhou, and the implementation of PPG 13 in the UK exemplifies the application of spatial planning. The resulting strategies centered on encouraging the use of public transport (transit) and mixed development (functional and density mixes) along its corridor for transforming automobile centered mobility. This is coupled with the integration of walking and cycling infrastructure within the corridor, and park and ride facility to permit use of transit and long stay in city centre. In the same light, strategy for containing congestion for road users is also put in place (RTPI, 2007, p.27 and 83, Cervero 1998, p. 292f, Breheny 1995, p. 86f, Whitelegg 2012, p. 7f, Rabinowitch and Leitman 1993 cited in Schipper and Fulton, 2002 p. 1791, Penalosa, 2004, p.11, Hughes and Zhu, 2011, p. 2f, Beevers and Carslaw, 2004, p.5, Hashemi and Jalali cited in ITDP 2012, p. 12f). The effectiveness of spatial planning here is seen in its capacity for sectoral integration across the components of the integrated strategies. This integration effectively supports the provision of transit services, reduced private automobile usage, smart compact transit-oriented development and making the city sustainable.

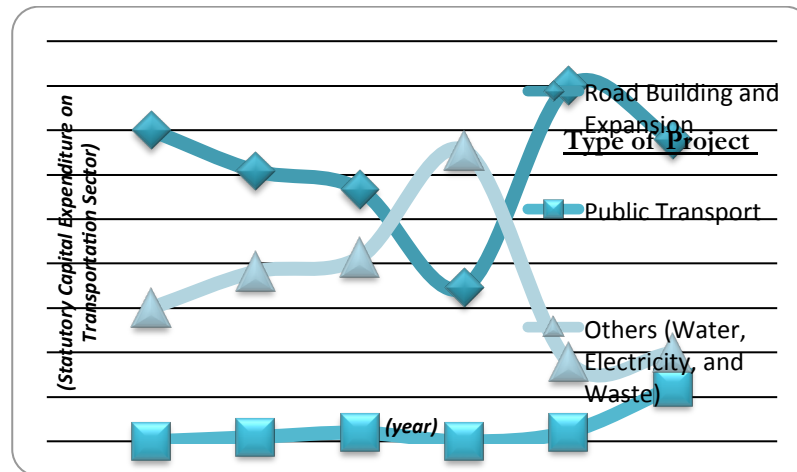
5 Results and Discussions

Data collected from the various methods are analysed to reveal the existing challenges and potential solutions. The theme of the analysis include existing statutory capital

expenditure on building and expansion of roads, TOD and existing policy on affordable housing on suburban area of Kubwa-Bwari axis.

5.1 Statutory Capital Expenditure on Building and Expansion of Roads in Abuja

The structure of expenditure on transportation sector between year 2003-2008 (road building and expansion, public transport and other road-related infrastructure project) in Abuja is illustrated below in Chart 1.



Source: Department of Treasury, FCTA / The National Assembly, Abuja (2012).

Chart 1: FCT-Abuja Statutory Capital Expenditure on Transportation Sector (2003 – 2008)

The available record on capital expenditure in the Abuja indicate that funds for building and expansion of roads have been prioritised and sustained, while funding for public transport has been abysmally low. Hence, this clearly illustrate the predict and provide engineering solution that characterizes the existing urban planning system in Abuja. Practitioners in the FCT Transport Secretariat opined that the philosophy of the capital expenditure needs to be redesigned to reflect priority of investments on transit infrastructure and reduced emphasis on road building and expansion. Thus, it is hoped that the change in expenditure pattern would leapfrog the city away from the quagmire of automobile dependence towards efficient sustainable low carbon transport system based on the application of spatial planning strategies as Transit, TOD, and Congestion Pricing that is capable of achieving the needed shift in paradigm.

5.2 Reducing Transport-related CO₂ Emissions and Traffic Congestion Challenges with the Application of Spatial Planning Strategies on the Kubwa-Bwari route in Abuja

The analyses in this section reveal the CO₂ emissions and traffic congestion levels in the existing scenario and also illustrate the potential savings achievable when the stated spatial planning strategies; Transit (BRT), Transit Oriented Development (TOD), and Congestion Pricing in the new scenario are implemented.

5.2.1 Transit (Bus Rapid Transit - BRT)

The transit regime would be implemented with the replacement of the existing commuting via small-capacity, tightly-packed, polluting and un-reliable *mini-buses* and the reduction in the level of *private automobile* trips. These two modes account for 95% of total daily motorized commute on the Kubwa-Bwari route as at November 2011.

5.2.1.1 Transforming the existing mobility pattern on Kubwa-Bwari Route to a BRT System

The existing 4638 mini-buses (18 passengers) will therefore be replaced by 522 new articulated buses (160 passengers). In addition, the existing modal share of the major daily motorized modes; *mini-buses* - 4638 (15.60%) and *Private automobile* - 23,688 (79.68%) will be re-calibrated to reflect a new modal share, such that trips on new articulated buses (BRT) will be 55%, and trips on private automobile will be 45%. This will require converting 10,659 automobile trips to transit trips. It is envisaged that this transformation will be achieved because the service on the transit will be compellingly efficient enough to attract choice riders from private automobile use. The strong coupling of the park and ride facility into the BRT system will also encourage private automobile drivers to ride on the BRT, equally the congestion pricing system will also deter motorists and help reduce the level of private automobile usage.

5.2.1.2 Indices for Computations

The capacity of existing mini-bus - 18 passengers

The capacity of the proposed high capacity bus – 160 passenger articulated buses

Per capita fuel consumption of mini-buses in non-congestion scenario – 0.19444 litre per passenger

Per capita fuel consumption of mini-buses in congestion scenario – 0.24305 litre per passenger

Per capita fuel consumption of proposed articulated buses in non-congestion scenario – 0.078125 litre per passenger

Per capita fuel consumption of private automobile in congestion scenario – 1.28553616 litre per passenger

Daily passenger trips on mini-buses – 166,968 (home-work-home trips) on Kubwa-Bwari Route

Daily passenger trips on private automobile - 47,376 (home-work-home trips) on Kubwa-Bwari Route

*Passengers in typical 18-passengers mini-buses are spread across occupational line as thus; Civil Servants (5), Private Sector (4), Self-employed (7), and Unemployed (2). * (This ratio was arrived at based on a survey/interview of 32 numbers existing mini-buses)*

Congestion peak period refers to commuting volume in the morning 6 – 10am

Non-congestion non-peak refers to commuting volume in the morning/afternoon 11 – 6pm

CO₂ emission per litre of petrol = 2.4Kg

CO₂ emission per litre of diesel = 2.7 Kg

5.2.1.3 CO₂ emissions levels in the existing and proposed scenario

Using the standard of 2.4kg CO₂ (petrol) and 2.7kg CO₂ (diesel) emissions for every litre of fuel used by automobile vehicle, the CO₂ emission level on the Kubwa-Bwari route is analyzed in this section (See Table 1.0).

Table 1.0: Profile of CO₂ emissions

Scenario	Bus System		Private Automobile		Total Yearly CO ₂ Emission (Kg)
	Mode	Yearly CO ₂ Emission (Kg)	Mode	Yearly CO ₂ Emission (Kg)	
Existing Scenario	Old Bus - 4638 buses (15.60% of Daily Motorized trips)	21,892,085	23,688 (Cars) = 79.68% (Daily motorized trip)	70,160,902.405	92,052,987.4057
Proposed Scenario	New Bus – 4638 old buses replaced by 522 new articulated buses	8,446,135.258	10,659 cars = 45% (Daily motorized trip)	31,570,628.959	40,016,764.217
Savings	Savings (CO ₂)	13,445,950.49		38,590,273.446	

Source: Authors Field Survey, 2012.

With the aggregation of the savings from the new transit-dependent mobility and reduced private automobile usage, the CO₂ emission level of the existing scenario is reduced from 92,052,987.4057Kg CO₂ to 40,016,764.217 Kg CO₂. This indicates a remarkable saving from the application of the BRT strategy. Undoubtedly, this savings will progressively improve as the efficiency of the new transit regime improves and attract choice riders from private automobile mode.

5.2.1.4 Fuel Usage levels in the existing and proposed scenario

With the per capita fuel consumption of non-congestion non-peak period of 0.19444 litre litres per passenger and congestion peak period of 0.24305 litre per passenger, the total yearly fuel usage for 166,968 passenger trips (home-work-home trips) on the existing mini-buses was computed. Similarly, by analyzing the per capita fuel consumption of 1.28553616 per litre for 95,752 total daily passenger trip (home-work-home trip) by private automobile trips, the yearly fuel usage was computed (See Table 2.0).

Table 2.0: Profile of Fuel Consumption

Scenario	Bus System		Private Automobile		Total Yearly Fuel Usage (litres)
	Mode	Yearly Fuel Usage (litres)	Mode	Yearly Fuel Usage (litres)	
Existing Scenario	Old Bus - 4638 buses (15.60% of Daily Motorized trips)	9,121,702.395	23,688 (Cars)= 79.68% (Daily motorized trip)	29,233,709.335	38,355,411.73
Proposed Scenario	New Bus – (4638 old buses replaced by 522 new articulated buses	3,128,198.243	10,659 cars= 45% (Daily motorized trip)	13,154,428.734	16,282,626.977
Savings	Savings (Litres)	5,993,504.152		16,079,280.601	
	Savings (₦)	₦ 581,369,902.7		₦1,559,690,218.29	

Source: Authors Field Survey, 2012.

With the aggregation of savings from the new transit-dependent mobility and reduced private automobile usage, the fuel usage level of the existing scenario is reduced from 38,355,411.73 to 16,282,626.977 litres of fuel. This indicates a remarkable saving from the application of the spatial planning strategies.

The savings realized is not only because choice riders are attracted as a result of reduced commute time on the BRT, quality bus services, but also because of the disincentives created by congestion pricing that will make driving during peak hours expensive for motorists.

5.2.1.5 Man-Hour Wastages in existing and proposed scenario

Using the data on the occupation structure and income class of passengers on the existing mini-bus system and private automobile, the total income loss due to man-hour wastages in congestion is hereby analyzed in this section (See Table 3.0).

Table 3.0: Profile of Man-hour loss

Scenario	Bus System		Private Automobile		Total Yearly Man-hour loss
	Mode	Yearly Man-hour loss	Mode	Yearly Man-hour loss	
Existing Scenario	Old Bus - 4638 buses (15.60% of Daily Motorized trips)	6, 523,292 hours (₦ 642,213,323.526)	23,688 Cars= 79.68% (Daily motorized trip)	4,933,104 hours (₦ 1,027,730,018.7)	11,456,396 hours (₦ 1,669,943,342.2)
Proposed Scenario	New Bus – (4638 old buses replaced by 522 new articulated buses)	-	10,659 cars = 45% (Daily motorized trip)	2,219,771.8 hours (₦ 462,422,621.9)	2,219,771.8 hours (₦ 462,422,621.9)
Savings (man-hour)		6, 523,292 hours (₦ 642,213,323.526)		2,713,333 hours ₦ 565,307,396.83	

Source: Authors Field Survey, 2012.

The aggregation of savings for the new transit-dependent mobility and reduced private automobile usage shows that the level of man-hour implicit to the existing scenario is reduced from 11,456,396 hours (N1,669,943,342.2) to 2,219,771.8 hours (N462,422,621.9) in the new regime.

It therefore suffices to note that if this existing scenario continues unabated, the carbon footprint and traffic congestion on the Kubwa-Bwari route (as with other routes: AYA and Airport Road routes) would soar and further de-leverage the sustainability of mobility in Abuja. Thus, the implementation of spatial planning strategies becomes imperative to achieving the proposed scenario of transforming the existing mobility via mini-buses to a BRT system, and to reduce the level of daily private automobile trips to emphasize more commute via transit trips in Abuja.

5.2.2 TOD and FCT STDA policy on affordable housing in suburban areas

The Kubwa-Bwari axis is characterized by both planned and un-planned development. Data from direct personal observation, and in line with satellite imageries reveals that the planned areas cover approximately 37% with density of 160 persons per hectare and un-planned area covering 63% of the entire Kubwa-Bwari area with density of 195 persons per hectare. Though the latter reflect intensity of development, they

constitute extensive, tightly-packed, spontaneous, un-regulated haphazard un-hygienic living environment. In addition, the locations of this site are not tied to existing commuting route and transit corridor. With this prevailing pattern of development unabated the trend of sprawl (suburbanization) will be exacerbated and further increase commuting distances between the core city employment areas of Abuja. When this is compared to 294 persons per hectare exemplified along the transit corridors and within the nodes in Curitiba (Cervero, 1998, p. 285), Bogota, and Guangzhou, the existing density in the Kubwa-Bwari axis is at best medium density development.

In recognition of the growing biases and infrastructure deficit in the growing suburban areas of Abuja, the FCT STDA has started implementing the affordable housing programme in suburban areas including the Kubwa-Bwari axis. This is expected to provide housing delivery to low income spectrum of the populace who live in suburban areas. However, available data on these projects reveals that the affordable housing sites in Bwari is characterized by extensive spatial form devoid of high density development. Notably, the locations of the sites are not tied to any transit corridor. The consensus of opinion of practitioner in FCDA and STDA indicates that the key to transforming suburbanization and automobile dependence lies in identification of potential nodes in implementing the affordable housing programme along Kubwa-Bwari route and the peri-urban settlement of the Kubwa-Bwari axis. It is also noted that, by evolving PPG Notes to guide the use of infill, intensification and new Greenfield development is pertinent to achieving TOD character. This new pathway will lead to increased and richer density along the route and within Kubwa-Bwari peri-urban axis and firm up the city's spatial form, reduce the increasing distance between core-city employment area and suburban residential area.

5.2.3 Congestion Pricing

Practitioners in the FCT Transport Secretariat and DRTS opined that when the transit regime becomes operational in Abuja, and transit services are optimal enough to attract choice riders from other modes, the congestion pricing regime will become desirable. Consequently, congestion pricing regime will be introduced with the aim of deterring private automobile commuting during peak hours into the core-city's Traffic Restricted Zone (TRZ).

The FCT Transport Secretariat will issue relevant PPG directed at implementing this congestion pricing regime, based on the defined Traffic Restricted Zone (TRZ) to circumscribe the Federal Capital City Abuja (City-Core). With this system in place, entering the TRZ will require pay permit or penalty for entrants. The Automatic Number Plate Recognition (ANPR) technology will be adopted, and this will rely on licensed plate of private automobile vehicles and cameras with ANPR technology installed at designated location around the perimeter of the TRZ. Based on daily, weekly, or annual permit into the TRZ, the drivers' number plate is registered as authorized vehicles on the data base for the time period requested.

It is hoped that additional transit trips from private automobile drivers deterred by congestion pricing due to the increased cost of driving will be attracted to transit. This in addition will retrofit the CO₂ emission levels and traffic congestion related challenges.

6 Conclusions and Recommendations

The existing urban planning paradigm in Abuja is characterized by the predict and provide engineering solution of road building and expansion. Increasingly, this has permitted suburbanization expressed in overly extensive spatial developments which are not only not-aligned to transit corridor but also lack the density and diversity that can support and optimize transit operation. They are at best overly extensive spatial development that lay the city on its back and increase the commuting distance between core-city employment area and suburban residential area which necessitate automobile dependent mobility pattern.

This study has demonstrated that automobile-dependent mobility pattern is indeed plagued with the challenges of CO₂ emissions, traffic congestion and related man-hour and fuel wastages. Consequently, this necessitates the shift towards *spatial planning* which focus on strategies that emphasize transit-dependent mobility, decentralization and aligning new development (TODs) along transit corridor. By this, spatial planning approach present valid opportunity to transforming sprawling cities to smart compact spatial form. Evidently, this new transit-dependent regime is characterized by reduced automobile-dependent travel which dwarfs transport-related CO₂ emission footprint and traffic congestion challenges of fuel and man-hour wastages.

Consequently, it is recommended that a renewed policy framework that leverages existing urban planning institutions be evolved, so that spatial planning becomes institutionalized. By this, the new spatial planning regime will creates an efficient framework for synergy and sectoral integration across sectors and stakeholders relevant to transforming the existing situation towards smart compact spatial form and transit-dependent mobility pattern. Indeed, it is pertinent to evolve appropriate PPG notes for implementing these strategies in Abuja. By this, effective implementation of these spatial planning strategies will serve to reduce transport-related CO₂ emission footprint, serve as climate change mitigation strategies, reduce traffic congestion challenges, and reduce urban sprawl/suburbanization trends in Abuja.

Quite astonishing, the dearth of funds and time did not affect the integrity of data presented here because this study was singly funded by the author. But, it rather inhibited wider scope of analyses of other potentials savings (e.g. particulate matter air pollution, traffic accident) realizable from the application of spatial planning strategies. The remarkable evidence of savings revealed in this study on transport-related CO₂ emissions, man-hour and fuel wastages from the application of spatial planning strategies illustrate the efficacy of the model at producing optimal results. Therefore, further research efforts are needed to elucidate on other potentially realizable savings implicit to the application of spatial planning strategies.

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Using organisational redesign to support energy reduction and resilience in the operation of a UK hospital: developing the research strategy

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Abstract

This paper explains how organisational redesign through the application of Occupancy Analytics (Bacon, 2012) is being used to inform clinical users in an NHS hospital of the means to adapt operational policies to achieve significant improvement energy consumption. Two major risks make this an imperative: The Carbon Reduction Commitment which requires a 50% real-terms reduction in carbon emissions and the recent report by OFGEM (2012) which warned that by 2015/16 the UK is very likely to be exposed to a significant shortfall in energy supply. The former demands a significant reduction in energy consumption and the latter emphasises the need for NHS Trust's to develop an energy resilience strategy. The paper discusses the potential impacts of uncontrolled energy consumption in the NHS and how this situation could substantially impact the resilience of NHS hospitals to the forecast under-supply of energy in the UK. It discusses the issues of resilience and considers what actions NHS Trust's need to take in order to develop a resilient energy strategy to manage the risk of under-supply of energy at times of peak demand. The energy supply industry advocates that Demand Response Control (DRC) is used as a means of encouraging consumers to manage consumption during peak periods.

Keywords

Clinical User Behaviour, Demand Response Control, Energy Resilience, Hospital Design, Occupancy Analytics.

1.0 Introduction

There is now sustained evidence that demonstrates that UK hospitals are failing to achieve the performance required by the UK Government's Carbon Reduction Commitment. The primary source of this evidence originated from the NHS Sustainability Development Unit (SDU, 2009), which reported that actual carbon emissions were increasing not falling, and that the rate of increase is diametrically opposite to that which is required. Three years later, the overall rate of increase of carbon emissions during 2012 is now reported to be leveling off (SDU, 2012). However, the SDU reports that the HM Government's Spending Review, (which has substantially impacted the funding of capital investment projects), has lead to a beneficial impact on the forecast carbon emissions in that they are now expected to reduce.

Yet the need still remains: to reduce absolute emissions from the existing health care estate in order to meet the target set by the Carbon Reduction Commitment. In this regard, the same report shows that building efficiency (the green zone in the diagram above) in terms of carbon emissions is forecast to continue to rise. The issue of building energy efficiency is important not so much because of the potential carbon emissions that could be saved, but also because it relates directly to energy consumption in the health care built environment.

Update to 2015 forecast

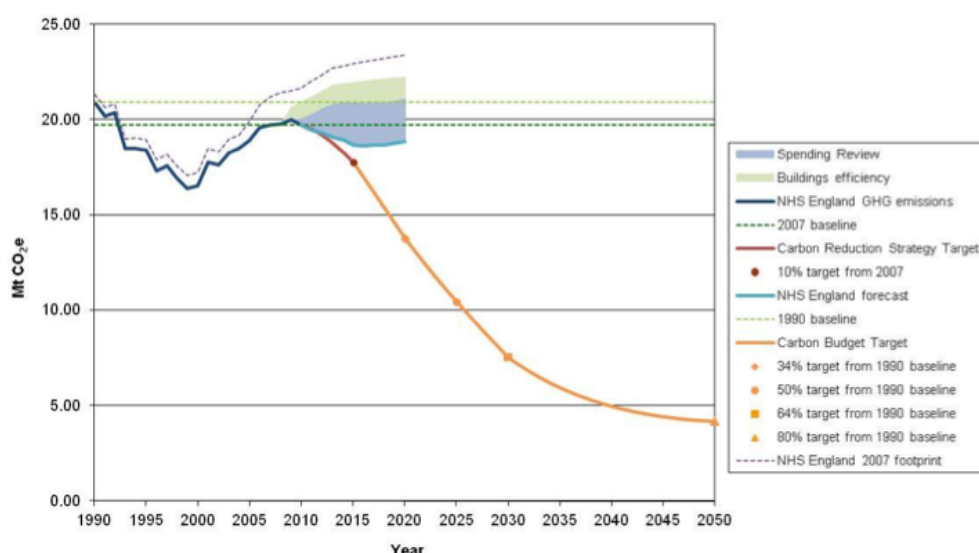


Figure 1 – Forecast carbon performance in the NHS Estate relative to the Carbon reduction Commitment

The importance of this issue is emphasised by the call for expressions of interest to bid for £50m of capital funding from the Department of Health in January 2012:

The funding will support new and innovative projects to improve energy efficiency, reduce carbon emissions and increase resilience to climate change as set out in the NHS Carbon Plan.

It is this aspect of carbon performance, that of substantially improving building energy efficiency and resilience, which is the focus of this paper. It is an important issue for the NHS, because the effect of uncontrolled energy consumption has an impact beyond rising operating costs, because as will be explained, the impact could also impact patient safety and well-being. Why is this? The issue is one of energy resilience and the recent OFGEM report questions the resilience of the UK energy supplies. The report (op cit) states the highest risk of an energy shortfall will be during the period 2015/16.

Management of these risks is based on a number of different strategies, largely focused on infrastructure investment and demand reduction. It is to the latter that OFGEM refers to as Demand Response Control (DRC). DRC requires consumers to manage consumption more effectively and most notably to manage peak energy consumption (peak load reduction), which OFGEM state commences at about 11:00am each day. It

is in the period of peak load consumption that the UK is at greatest risk from the forecast energy shortfall. It also happens to be the period where hospital energy consumption also peaks. Should such a shortfall arise it is conceivable that NHS Trusts would be requested to reduce consumption at short-notice, and as such Estates & Facilities directors and their key suppliers would be required to make critical decisions concerning which clinical services to shut-down. Without knowledge of how much consumption needs to be preserved for key services or departments, Estates & Facilities Engineers could find it very difficult if not impossible to make informed decisions. This represents a significant risk to the NHS hospital trust. In considering the need for energy resilience the NHS Sustainability Development Unit (SDU, 2009) makes a number of recommendations, two of which are most pertinent to this paper:

- *All NHS organisations should create a strategic plan to develop resilient and more renewable energy sources to ensure a guaranteed energy supply, whilst managing their overall carbon footprint.*
- *Every NHS staff member should be able and encouraged to take responsibility for energy consumption and carbon reduction.*

What does resilience mean and how should NHS Trusts use this understanding to develop a resilience strategy? How can NHS staff be encouraged to take responsibility for energy consumption, such that it results in dramatic reductions in consumption?

1.1 Resilience in energy supply

The UK Energy Research Center (Chaudry, 2009) defines resilience as:

“Resilience is the capacity of an energy system to tolerate disturbance and to continue to deliver affordable energy services to consumers. A resilient energy system can speedily recover from shocks and can provide alternative means of satisfying energy service needs in the event of changed external circumstances.”

Perhaps more useful however, would be to consider the characteristics of resilience. Fiskel provides an insight (Fiskel, 2003):

“In engineering, diversity, efficiency, adaptability and cohesion are characteristics of resilience. ‘Diversity’ implies a wide range of alternatives, such as multiple product offerings or production sites. ‘Efficiency’ refers to resource productivity, including eco-efficiency. ‘Adaptability’ describes the ability of an organisation to change practices, resource allocations, designs, relationships, or other aspects of business in response to changing conditions. ‘Cohesion’ is taken to mean the strength of relationships internal and external to the organisation, such as customer loyalty, supplier relationships, corporate culture, and employee identity.”

Whilst others may define the characteristics of resilience differently, the concepts of ‘Diversity’, Efficiency’ ‘Adaptability’ and ‘Cohesion’, would seem to be very useful starting points for the development of strategic plan to develop resilience, as recommended by the SDU. For example where OFGEM is considering demand response strategies, an organisation able to adapt by changing working practices and

resource allocations would be one that could develop resilience to fluctuating energy supplies. The author will argue that the ability of an NHS Trust to adapt its working practices to manage energy consumption could be an important element of a resiliency strategy. Returning to Fiskel's characteristics of resilience: From a corporate culture perspective, could new working practices be expected to emerge founded in employee behavioral change? Could these changes of working practices at least result in greater adaptability, energy efficiency and reduced carbon emissions?

2.0 Hypothesis

It would be through this kind of thinking where improved staff engagement could result in staff taking responsibility for energy consumption and carbon reduction. This raises the question as to how such engagement could lead to significantly reduced consumption – even if such reduced consumption were to be possible? In reflecting on these issues the author has considered the following hypothesis, which considers the following variables:

If a Trust were able to develop *cohesive* employee engagement in low energy- low carbon performance and in so doing *adapt* its working practices such that they would lead to *efficiency* of energy use, it should be possible to achieve resilience to a future shortfall in energy availability.

2.1 The added value of engineering energy resilient hospitals

Whilst the objective would be to achieve resilience to shocks to its operation, this paper will also explain the value to the Trust of the following efficiency gains that could also arise through the implementation of a resiliency strategy:

- Reduced energy costs
- Improved productivity
- Improved space utilisation

These benefits alone could be profound, and consequently even if an energy shortfall such that as forecast by OFGEM were not to materialise, the author will argue that an added value benefit to the Trust could be one where would be leaner and more agile in having attempted to mitigate the impact of such a risk to it. Furthermore, should all Trusts adopt such a strategy the potential to impact building energy efficiency could be substantial. This would address a key concern of the SDU to drive down carbon emissions in the NHS Estate through efficient use of facilities, which accounts for nearly 20% of all carbon emissions from the NHS Estate. Specific to the built environment, the Royal Academy of Engineers reported in 2011, that buildings today perform little better than they did in the 1980's (RAE, 2011). This underlines how little impact improvements in asset specifications have made on overall carbon emissions.

The empirical evidence to support this argument can be found in a comparison of the results published in the report titled: *Hospital Energy Performance: New Indicators for the National Health Service Estate* (J. M. Williams, 1999) and the report: *Greener Hospitals: Improving Environmental Performance* (Environment Science Center, 2003) as illustrated in Figure 2 and Figure 3.

The author's reflection on these issues is that it is the working practices used in contemporary hospitals that is the central issue as to why there is still excessive consumption, and why it is generally that buildings today perform little better than they did in the 1980's and 1990's. The conceptual difference could be explained by the author's diagram in Figure 2.

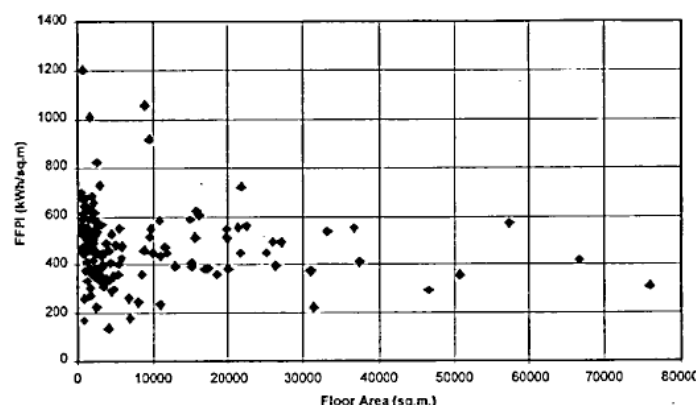


Figure 2 - Thermal energy consumption of UK acute hospitals - 1994/1995
(J. M. Williams, 1999)

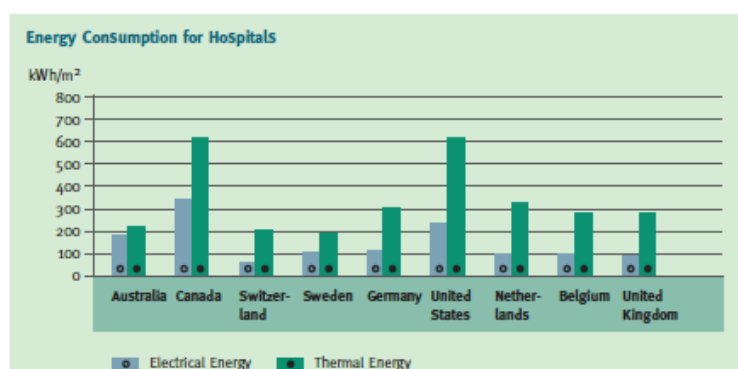


Figure 3 - Comparative European hospital performance – 2003
(Environment Science Center, 2003)

With respect to hospital operations, they tend to be much larger than 30 years ago and are also highly serviced in comparison. IT systems and extensive use of diagnostic equipment also account for these differences. However, it is also quite possible that it is clinical user behaviour that also leads to excessive consumption. Yet the Carbon Reduction Commitment requires a real-terms reduction in carbon emissions, and consequently it is imperative that society finds the means to achieve the commitment. The H.M Governments Innovation & Growth team *Low Carbon Construction* report that advocated a fundamental change in the way that UK public facilities are both *designed and operated* (IGT, 2010). In other words the processes involved in both the design and operation need to be fundamentally challenged. This issue is a central theme of this paper.

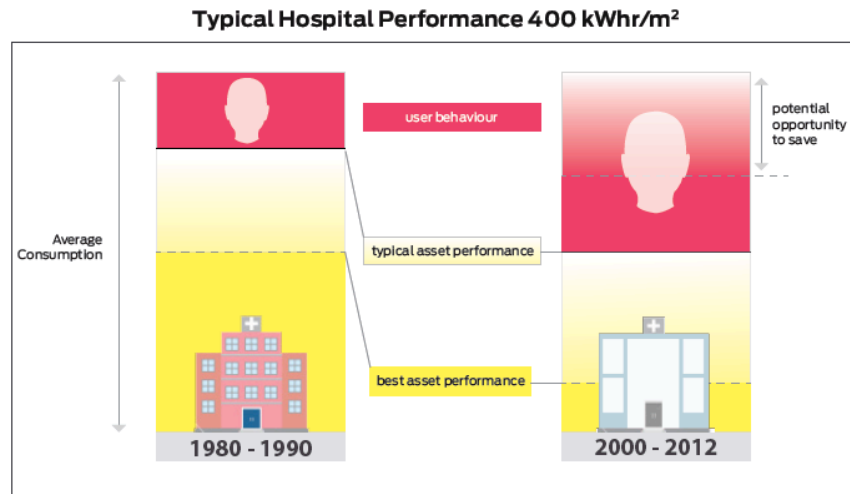


Figure 3 - Comparison between 1980's and contemporary energy consumption.

3.0 Literature review

What evidence is there that NHS Trust's have embraced the low energy / low carbon agenda? In particular is there evidence of *cohesive* employee engagement leading to *adaptation* of working practices leading to efficiency of energy use? If so, then it could be expected that there would be evidence of this in terms of efficiency of energy use, as well as examples of the adaptability in service design? Both would suggest the need for new model of practice. The author's own experience is that current practices are so embedded in NHS culture (and sometimes for good reason) that driving fundamental change in practice presents substantial resistance to change, a point made by McNulty (T. McNulty and Ferlie, 2002), where it was observed:

"Important regulating forces (notably the State and the professions) were here seen as constraining permissible patterns of organisational behaviour, no where more so than in the public sector, where these regulating forces are strongest...including an awareness of the importance of the underlying organisational ideology as well as more evident structural factors"

The evidence from McNulty, suggests that unless the consultants that lead each department can be engaged in the change, such that they become not a constraint but a positive force, then change is unlikely to happen. However, any change (for example adaptation of working practices) is also likely to be constrained by them if such a change results in personal impacts such as reduced income or patient impacts such that new working practices conflict with clinical outcomes. It is clear therefore that a change management strategy must be focused towards the clinical leadership teams in the hospital. Coincidental with the need to fundamentally change working practices has been the UK government's reforms in the NHS. The most current review at the time of writing is the National Audit Office report titled: *Progress in making NHS Efficiency Savings* (NAO, 2012). This report is relevant to the author's hypothesis because it provides a valuable insight into the propensity for NHS Trusts to deliver efficiency improvement, without simply cutting services and the resources to deliver those services. Without such evidence it would raise the question as to how achievable such a strategy would be.

A few insights to this concern can be gleaned from this report:

- *Primary care trusts do not measure or report NHS efficiency savings in a consistent way, undermining the quality of the data. The Department has provided limited guidance, and as a result primary care trusts measure and report savings differently. For example, the costs associated with generating savings are not consistently deducted from the figures reported.*
- *Evidence indicates that the NHS has taken limited action to date to transform services. There are a number of challenges to delivering service transformation. Changes take time to implement and may initially cost, rather than save, money. In 2011-12, the proportion of cash-releasing savings reinvested in transforming services varied and there is no evidence of a shift in staff from the acute to the community sector.*

The evidence is not encouraging, but the NAO observes that some efficiency improvements actually result in increased costs in the short-term before longer-term savings are accrued. From this evidence, which is the latest available it is clear that there has been little service transformation, in other words what the author refers to as *adaptation of working practices* leading to improved service efficiency. This issue will be returned to later in this paper. Concerning *efficiency of energy use*, the 2012 SDU NHS Carbon Footprint report, previously referred to, highlights the poor overall building energy efficiency in the NHS Estate in England. However because the data on which this report is based, is highly aggregated from all NHS Trust data it is likely that an ageing estate comprising energy inefficient buildings obscures data highlighting good practice and energy efficient exemplars. Nevertheless, with a lack of consistent reporting standards the repeatable strategies that lead to improved efficiency will be difficult to appraise. The lack of In-Use data clearly inhibits an accurate assessment of sustainable performance, notably in terms of energy and associated carbon performance, which is a key focus of the author's research and for this paper. This finding was underlined by the BRE report (BRE, 2003), written nine years prior to the NAO report, titled: *Sustainability lessons from PFI and similar private initiatives*, it commented that:

- *When setting a brief the client needs to specify criteria for targets so that tender briefs can be compared on a like for like basis.*
- *A common finding was that no energy targets were set on the projects that were evaluated.*

Clearly the current situation is one that is not new; it has existed for decades. The findings of the NAO and BRE reports into the public estate are also confirmed by academic literature. Bordass and Cohen have long been commentators of 'post-occupancy' reviews. In their paper *Energy Performance of Non-domestic buildings*, (B. Bordass et al., 2004) they cite the challenge of accurately reporting energy use in non-domestic buildings. They too highlight the need for:

- A specification for In-Use data collection.
- Users required to set outcome performance metrics

Perhaps the lack of metrics is reflective of the complexity of achieving process redesign? Clearly without understanding the process and having measured it, then the

metrics needed to inform redesign would be absent? It was in *Complexities in organisational transformation* (T. McNulty and Ferlie, 2002) that the complexities of process reengineering, using a singular case study at Leicester Royal Infirmary, were investigated. The hospital management team attempted to make serious and sustained change. The process of change was highly contested and the results were variable across the organisation. The authors pointed to the doctors that controlled the working practices and the reengineering team found it difficult to reshape working practices. The authors found that:

“...local behaviours reflected the sectoral context of UK health care, with its distinctive assumptions, strategic recipes, and regulating institutions. The pattern of professional dominance (Friedson, 1970, 1994) was still observable at the clinical level and was not effectively challenged...”

This latter issue summarises the challenge: that is to define and measure environmental design factors associated with patient and staff outcomes. It will be these measures that will be used to validate the author’s hypothesis: in other words the efficiency of energy use and adapting services to manage energy consumption as a means for reducing the potential impact of shortfall in energy supply.

All NHS Trusts in England are required to submit estate returns to the Department of Health and these are then processed into the ERIC database used by the NHS SDU to publish the annual carbon footprint report. The data that is provided is highly aggregated and relates to overall energy consumption of each estate. However there is limited field of research evidence as to the implementation issues as they relate to building specific energy and carbon plans for NHS hospitals. There appears to be a clear gap in our knowledge as to the social and cultural issues that NHS hospitals are faced with in the achievement of *cohesive* employee engagement in the drive for low energy and low carbon performance. The gap in our knowledge referred to above was articulated in a UCL Energy Seminar in December 2012 (Nicholson, 2012). The introduction for the seminar raised the following challenge:

“Energy demand reduction is too often treated either as either entirely technical domain, or wholly cultural one. Technical measures – boilers, insulation and voltage optimisation – may not grab the public imagination, but they are effective, measurable and deliverable. Cultural measures on the other hand – like user engagement, behaviour change and energy literacy – hold enormous promise to unlock additional savings but are still seen by business and policymakers as fluffy, unpredictable and unquantifiable....

The introduction then succinctly summarises the work that is required:

...By bringing together a science and engineering approach with user-centred design techniques, could we unlock massive savings that at present are left on the table?

Herein lies the potential to unlock massive savings with equal potential to reduce energy consumption, the basis of those savings, and in doing so to achieve energy resilience. However the barriers to achieving this potential cannot be underestimated. As has already been explained, hospital users (clinicians and managers) often lack the necessary information to enable them to understand the need for change and importantly to understand how in the way that they use the hospital facilities, they

impact the energy and carbon emissions of that facility. Starved of meaningful performance data means that making the case for change and measurement of the improvement of change (benchmarking) makes the challenge even more difficult. This is also a point made by McNulty (op cit) quoting Hammer and Champy, who lead the process reengineering movement in the 1990's:

“Process redesign requires...imagination, inductive thinking, abandoning familiar ways of working, and suspending beliefs in time-honoured rules, values and procedures...people need be educated in the need for change...the keys to getting people to accept the need for change...lie in the process of education, about the need for change, communicating change, and selling change to employees...”

Yet as McNulty also observes:

“Process reengineering is more appropriately seen as a social process, inseparable from the power and politics of the organisational setting.”

Consequently, as was discussed earlier, traditional process engineering methods are unlikely to deliver the results that are aspired for. Instead the clinical leadership teams (i.e where the power to make change resides) in the hospital need to become engaged in the process of change to achieve both the desired clinical outcomes as well low energy and low carbon performance. Consequently the research challenge remains: which will be to identify the means by which *cohesive* clinical user engagement in low energy performance could be achieved and which would also lead to a reduction in peak energy demand. The need therefore is to engage clinical users in hospital facilities in a way that recognises both the organisational culture, and most notably the professional dominance of key workers, in all parts of the hospital.

4.0 Research philosophy

In evolving a research strategy to validate (or maybe to develop) the author's hypothesis, the foundation of the author's 'research habitus'¹ (Bourdieu, 1984) must be stated. The author's 'research habitus' is probably primarily shaped as being that of an architect, a profession, which is both a merging of science and art, and inevitably shapes the philosophical starting point that drives the strategy. In this sense architecture could be seen as a merging of both positivist (science based fact) and constructivist (human experience learned through interpretation), which could be described as a 'world view' (K. Niglas et al., 2008), where realist ontology and relativist epistemology are merged through a continuum. This is also the very essence of architecture and engineering, where the physical, or empirical world, as defined in terms of building physics for example, needs be harmonised with locally constructed realities experienced by users that know nothing of building physics perhaps, but experience architecture as what Rasmussen (Rasmussen, 1964) referred to as 'actors':

“...quite ordinary people – he (the architect) must be aware of their natural way of acting – otherwise the whole thing will be a fiasco. That which maybe quite right in one cultural environment maybe quite wrong in another”.

¹ Bourdieu defines this as a habitual state (especially of the body) and, in particular, a predisposition, tendency, propensity or inclination.

Translated into hospital design this could mean the clinical users experience and behaviours towards the use of environmental controls, operational policies, as well as their attitudes towards working practices that lead to uncontrolled energy consumption. It could also mean the users perceived needs for light, ventilation, heating and cooling as they work in the hospital. This author believes that reconciliation between the Positivist World and the Constructivist World is to be found in Leonardo Da Vinci's Vitruvian Man. In his famous painting we observe man perfectly formed at the centre of a circle and of a cube; both regarded as divine geometries. There have been many interpretations, but the author prefers that where the circle represents man as part of the universe, of man's ethereal being. Whereas the square represents man at the centre of nature, of the earthly (natural and human) sciences, concerned not least man's relationship with the environment. The author has formed his own interpretation of Vitruvian Man to illustrate his 'Real World' perspective that seeks to synthesise the Positivist and Constructivist perspectives, as illustrated in Figure 4.

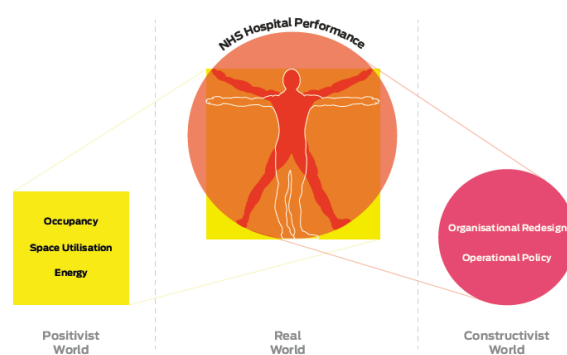


Figure 4 - A Real World Perspective

The author has previously argued (Bacon, 2012) that there is an unfortunate divide between the supply side understanding of how hospitals should be engineered for use, and the users understanding of how it should be used (and experienced), despite how it was engineered. This work clearly demonstrated the importance of accurate requirements specification of the hospital engineering systems to enable the clinical users (should they wish) to achieve low energy use. It is though the need to reconcile these perspectives that leads the author to that of a 'critical realist' position, founded in mixed methods. This position establishes the context for the research strategy.

5.0 Research strategy

The research strategy has been profoundly influenced by the work already undertaken by the author in a study of the design and engineering process as it relates to low energy – low carbon design of UK hospitals. That work was predicated on the hypothesis that:

If it were possible to develop a deep understanding of how the hospital will be used (through the analysis of operational policies) and then to use this knowledge to inform the design requirements for the new facility, it should be possible to make the fundamental changes to the engineering design process to achieve new standards in benchmark performance... The author will demonstrate that this focus not only ensures that the impacts of forecast use, and occupancy are understood by the design team but new

data is created which obviates the need for the design team to make substantial assumptions concerning use and occupancy. These assumptions....are in the author's opinion, the over-riding reason for the common disparity, between forecast energy performance and actual energy performance achieved In-use, which was cited earlier.

The proposed strategy which will be explained shortly, borrows from Brannen (Brannen, 2008) where she states:

"...with the growth of strategic and practically orientated research which meets the needs of users, there is an increased need upon dissemination. Research must speak at least two languages – the technical language of research, and a language which makes research results accessible to a wide variety of audiences. Thus words become as important as numbers. Mixed methods allows for both"

As illustrated by the author in Figure 5, Brannen succinctly articulates the need for duality in communications – the language of the engineer concerned with the impacts of use on design, and the language of the user concerned with the In-use requirements of the facility as a means for delivering the service and of course low energy performance. A number of commentators, such as Bordass, Leaman and Cohen, as cited previously have observed in the built environment that the duality of communication often fails and for this reason can be described as the ‘great divide’. Without effective communication, users ability to drive for low energy use will be compromised by the engineering design. Two ‘languages’ are clearly required.

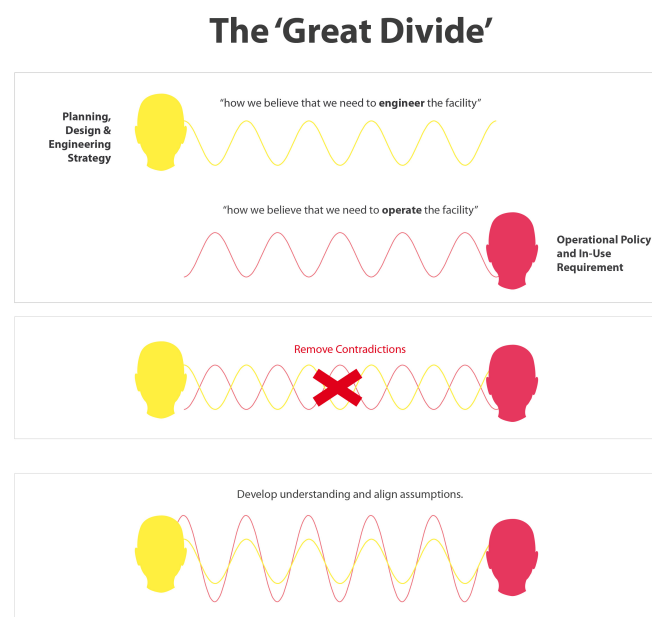


Figure 5 - Achieving alignment of engineering design and In-use operations

With regard to the specific theme for this paper, the reasoning in the next part of the hypothesis is particularly relevant:

Furthermore, in understanding the direct correlation between facility use and the energy and carbon consequences of that use, it ensures that users

are empowered to make informed decisions concerning alternative working practices, which would both achieve the required operational and carbon performance. This new understanding leads to the opportunity to optimise energy and carbon performance during the In-Use phase of the life-cycle and so further reduce carbon emissions.

Yet, the hypothesis in this paper speculates that in enabling users to make informed decisions concerning the energy impacts of use, that they would indeed adopt alternative working practices (revised Operational Policies) that would deliver improved energy efficiency and reduced carbon emissions as well as desired clinical outcomes. But would they? What factors would encourage/ discourage change? How could *cohesive* engagement be achieved and what are the circumstances that would lead to this?

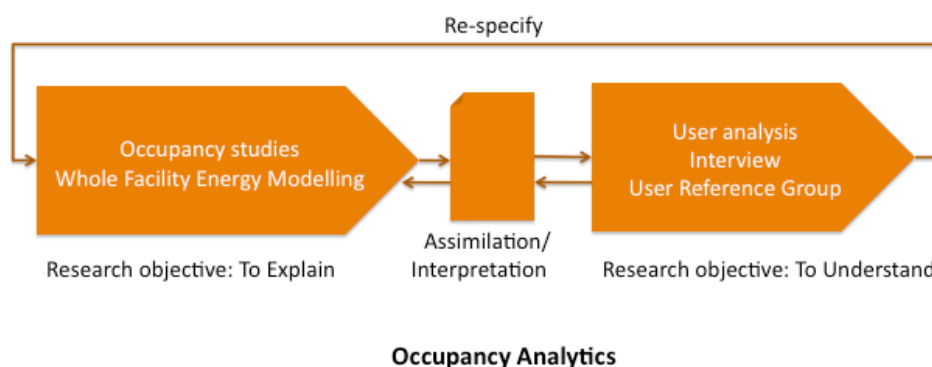


Figure 6 - Mixed Method Strategy

Figure 6 sets out the research strategy envisioned by the author. The strategy has three components:

1. Occupancy studies founded in quantitative data analysis (op cit). The focus here is on the impact of use on the engineering design and embraces those features of the process concerned with design and delivery of facilities. The objective of these studies was to explain *how* an improved understanding of In-Use could lead to significantly improved energy and carbon performance. The work also seeks to understand *how* the variables in the process lead to different performance outcomes.
2. Interpretation. To reflect on and understand through assimilation (and interpretation) of the former how the new information could impact the user's understanding of low energy – low carbon performance and thus lead to changes in working practices. At this juncture the research paradigm moves from a quantitative analysis to qualitative analysis.
3. User analysis founded in qualitative analysis. To understand how to develop *cohesive* user engagement could be achieved, and how to use the data from 1.0 to inform the need for change. Using the data from 1.0 and the assimilation in 2.0 to work with the users to develop new practices that would lead to new behaviours and thus sustained changes in low energy performance.

6.0 Research Plan

The opportunity to develop a dialogue with clinical users and to work with them to develop new practices that would lead to new Operational Policies and thus sustained changes in low energy and low carbon performance was presented by the Brighton & Sussex University Hospital's NHS Trust on the redevelopment known as 3T's. The work was a development of earlier occupancy studies at 3T's, where quantitative methods using data created out of Discreet Event Simulation and then processed through statistical analysis were carried out. Figure 6 explains this context. The strategy illustrated in this diagram anticipated that the occupancy data would be used to inform the clinical users as to the impact of working practices on energy use. The interpretation of the data would provide a basis for such a dialogue.

In discussion with the 3T's project leadership team it was agreed that a User Reference Group would be established and that through a series of structured workshops a rigorous analysis of the findings from the occupancy studies would be carried out. However, the User Reference Group is only a vehicle to enable the dialogue to take place. The question raised earlier, still remains: how could we achieve *cohesive* engagement?

(Pettigrew and Whipp, 1998) suggest a range of methods for introducing change into organisations. They suggest that effective change results from longer-term processes of *learning, conditioning and influencing*. This bears out the author's own experience in managing change in BAA plc where a complete reengineering of design and construction processes was implemented for the delivery of Terminal 5 (Bacon, 2007). The strategy was firstly to learn from the past and identify the causes of failure as well as success. Pilot projects were implemented and the results of these were used to inform the need for change. Later the knowledge gained from these pilot projects was used to inform the organisation and *condition* it to consider new ways of working. The *conditioning process* focused on the analysis of past performance and the development of new metrics. In doing so, BAA learned that it needed to measure performance differently, and so learn *how* it needed to bring about change. BAA used this new knowledge to *influence* change within the supply chain and with this new knowledge the supply chain was incentivised to innovate and strive for new levels of performance. How is this relevant to a Health Care environment? In regard to the *learning process* the parallels described by McNulty (op cit) are very clear, as was quoted earlier. He emphasises that:

"...people need be educated in the need for change...the keys to getting people to accept the need for change...lie in the process of education, about the need for change, communicating change, and selling change to employees..."

The research plan set out in this paper focuses on leading a process of change with the User Reference Group. Foremost in the learning process will be to help them to understand the impact of their current working practices (Operational Policies) on energy efficiency. Later papers will describe the work to develop new Operational Policies predicated on achieving both desired clinical outcomes and efficient energy use leading to low carbon performance. The plan that the team developed which was lead by the authors' consultancy business, and supported by the Trust's change management team, comprised the following stages within two streams of action:

Stream 1

1. Learning – communicating the need for change.
2. Conditioning – understanding the need for change – alignment with new energy management practices.
3. Influencing – consideration of new Operational Policies with energy budgets.

Stream 2.

1. Mechanisms for change – Vision for user engagement in energy management
2. Development of new energy management practices aligned to Operational Policies.
3. Establishing energy budgets – responsibility and accountability. Define new performance metrics that reconcile clinical outcomes and low energy use

The outputs of these activities are planned to ultimately result in new Operational Policies that are directly correlated to energy budgets for each department. Within each departments' Operational Policy it is expected that there will be:

- a) Accountability and responsibility for energy budgets.
- b) An incentivisation plan to encourage continuous improvement.
- c) Building controls and monitoring policies concerning the optimisation of energy performance during In-Use, such that clinical users work towards continuous improvement in budget performance of their department.
- d) Emergency energy reduction risk management plan to be implemented in the event of future energy-shortfalls.

6.1 Reflection and envisioning

The plan envisages that the two streams would be run concurrently, so that that each streams would inform the other. Stream 1 is focused on reflective discussion with the User Reference Group. The objective of the Learning stage was to help the users understand that the impacts of operational decisions on the patient experience for example; an issue that is directly influenced by their Operational Policies. Users perceptions and reflections on the factors that lead to stressful working conditions as well as challenges in meeting key objectives such as infection prevention and control, or patient dignity and well-being were discussed. But the Learning stream was also conceived to help the users understand that the impacts of these policies on energy consumption and specifically where they directly correlate to peak energy loads for the hospital. In aligning these two issues the author's objective was to demonstrate that there was a common purpose, albeit with two different outcomes. In such discussions the inevitable question arises: 'what can we do about this?'. This explains the reason for the two streams of analysis. In parallel with these discussions the potential mechanisms for change would be agreed, and importantly we would speculate as to how the operational and carbon impact agenda's *could be* reconciled. The emphasis on '*could be*' is important, because the author considers it fundamental that users are presented with possibilities that help to develop understanding – not preconceived notions that are often associated with '*to be*' strategies. The over-riding objective was to create the foundations for *cohesive employee engagement*', a key element of an energy resilience strategy.

Stream 2: Mechanisms for change, introduced the User Reference Group to the Occupancy Studies carried out under the earlier project for 3T's. The group was

introduced to the key concepts of occupancy analytics and the correlation between occupancy, and energy consumption. This enabled the discussion to move from reflection to speculation and so an understanding evolved as to how Stream 1 could both inform and be informed by Stream 2.

However, change needs to be informed by strategic context (Pettigrew and Whipp, op cit). The objective of Stream 2 was also to provide this context, part of which was the Trust's Carbon Management Plan. In addition to this was the author's vision (Bacon, 2012) for a new form of engagement with users in the optimisation of low energy – low carbon hospital performance. The vision was an attempt to articulate 'problem sensing' (Pettigrew and Whipp, 1998), a preparatory action involved in *conditioning* teams in helping them develop an understanding of the need for change.

7.0 Conclusions and future work

The Learning stream of Stream 1 commenced in June 2012. The follow up to this initial work is to commence in February 2013. The initial consultations were very encouraging, demonstrated by each departmental clinical leadership team's enthusiasm to work with the author's team to develop new operational policies that would reconcile the desired clinical outcomes and patient experience, with the pressing energy resilience needs of the Trust.

With this endorsement the work will now commence to develop the mechanisms to achieve *cohesive* employee engagement in order to *adapt* their working practices essential for energy resilience. The results of this work will be published in future papers.

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Contribution of Mortgages to the Performance of Real Estate in Uganda

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Abstract

Uganda's mortgage industry has witnessed a tremendous growth and is currently playing as the most important funding resource for the real estate market. Today's high mortgage interest rates in so far makes direct real estate investments less attractive to individual investors. Therefore this research examines not only mortgage contribution to the real estate sector performance but also how the mortgage industry can be improved upon. This was conducted among mortgage beneficiaries of various financial institutions. The objectives of the study are to determine the feasibility of terms and conditions in accessing mortgages and determining the relationship between mortgage financing and real estate performance. Precisely, random sampling and questionnaires were used in collecting primary data carried out by one hundred respondents hence SPSS used in data analysis. The findings revealed that mortgage financing and real estate performance are positively interrelated with a positive correlation and yet showing a backlog in housing facility. Moreover, high interest rates together with low levels of income hinder the use of mortgage finance.

Keywords

Interest Rates, Mortgage industry, Mortgages, Real Estate Investment, Uganda's mortgage Industry.

1. Introduction

The rise in mortgage interest rates and the cost of borrowing as an effect of the increase in the Central Bank Rate has damaged both the financial sector and the real estate sector. It has become more difficult for borrowers to service their loans. As a result, the number of non-performing mortgages and mortgage defaults has increased. The higher cost of borrowing has resulted into lower profits or losses for the commercial banks due to higher provisional charges. The performance of the real estate sector has declined as the output of the sector has decreased.

Real estate is one of the foremost and traditional investments in Uganda. Demographics, immigration to urban areas, urbanization, industrialization and renewal are the main components of the strong domestic demand for real estate. Only rarely will real estate investors pay the entire amount of purchase and development price of a property in cash. Usually the larger portion of this price will be financed using a financial or debt instrument such as a mortgage loan. Mortgage services in Uganda are currently provided by commercial banks. The flourish of this service not only injects liquidity to the real estate market but also brings profitable business opportunities to commercial banks. A mortgage is taken to buy property usually with specified periods of repayment and interest rates. The mortgage loan uses the property

as collateral to guarantee repayment of the loan. Economists, financial experts and policy makers agree that what is good for the housing sector is also good for the economy as a whole. It is also clear that the development of mortgage financing is strongly related to the general development and sophistication of the country's financial markets which in turn is closely related to the overall economic development

Ugandans have realized that with the ever-increasing rental costs and house prices, it would be more beneficial to take a mortgage and acquire property as one would be assured of invariable monthly payments due to fluctuations. Mortgage firms and banks facilitate purchase of homes and property through mortgage loans by providing the initial capital of up to 70% of the total cost which is paid back in small amounts with both the interest and the principal incorporated for a period of over five to twenty years. These institutions are very interested in mortgage loans and to attract customers, they maintain active and well-organized departments whose main objective is to compete actively for mortgage loans. They are given a security that is a lien on the land until the mortgage is fully paid off. Banks are willing to make such loans at favorable rates in large parts because if the borrower doesn't make payments, the bank can foreclose by taking a court action, which allows them to take back the property and sell it to get their money back.

The real estate sector in Uganda has seen developers who have entered the market and have innovatively teamed up with a number of local and international banks present in Uganda to extend their mortgage services to Ugandans. Companies like the Government owned National housing and Construction Corporation (NHCC) and private developers like Akright projects, Kensington Real Estate Company, Turipati Developments, Pearl Real Estate Developers and Jamayi Property consultants have worked out schemes through which middle income can access loans for the purchase of real estate through banks and other financial institutions.

According to the budget speech 2006/2007 (Mwenda, 2006), a large share of domestic and external savings is being channeled into residential and commercial construction. The share of private construction in GDP has increased from 8.8% in financial year 2000/01 to 15% in financial year 2005/06 (Suruma, 2006), accounting for almost the entire rise in private investment. This clearly shows that the easiest way for promotion in our economy using the private sector is through housing development. It is almost impossible to expand housing to scale without a vibrant mortgage industry.

2. Literature Review

2.1. Mortgage Interest Rates

In accordance with Stiglitz & Weiss (1981) the mortgage yield is not only influenced by macroeconomic factors but is also linked to the availability and the preference of banks. In Uganda, interest rates range from 16% to 23% depending on the mortgage purpose (Kibirige, 2006). Usually owner-occupier mortgages take the lower rate and it increases as one tends towards commercial mortgages. These rates are generally high and are attributable to the lack of long term local funding.

Mortgage Option

Home purchase
 Home construction or completion
 Commercial building purchase
 Commercial building construction,
 Equity Release mortgage
 Urban plot purchase
 Corporate Staff Mortgage,
 Mortgages for agricultural purposes.

Key Factors in Mortgage Lending

The payment term
 The size of the loan
 Maturity of the loan
 The interest rate
 The loan-to-value ratio.
 Actual and transaction value

2.2. Effect of loan rates on holding period return

When an individual uses borrowed funds to make a direct real estate investment, two things are being obtained: an asset—the real estate, and a liability—the mortgage loan. The price of both the asset and the liability influence the affordability of the transaction, and the interest rates that have characterized the market place recently have facilitated many transactions. A low interest rate means that an investor can afford to pay more for a property, *ceteris paribus* and a high interest rate makes it hard for an investor to pay for the property. A real estate investor's total return consists of two parts: the cash flow associated with operating the property, and the cash flow associated with the eventual sale of the property (reversion value). If an investor over estimates either component his or her realized return would be less than anticipated. Compared to a lower mortgage rate, a high rate results into increased mortgage payment that, in turn, results in reduced cash flow from operation. Mortgage rates fluctuate, however, and if they increase by the time the investor is ready to sell, the reversion value is likely to decrease causing the investor's realized return to fall short of expectations.

2.3. Eligibility

The amount borrowed from the bank must have a monthly repayment amount not exceeding thirty five percent of the borrower's ascertainable monthly income. Audited accounts for the last financial years together must be submitted

2.4 Loan Size

The minimum is five million shillings on property depending on location and value of up to 8% for residential units in Kampala, 70% for commercial and urban plots and 50% for residential units in other towns.

2.5 Repayment method and Repayment period

Through equal monthly installments in case of property purchase, the first repayment falls due on the first day of the following disbursement date. For construction properties, the first repayment falls due on the first day of the month following expiry of the grace period. Repayment is by monthly equal installments in a period of up to twenty years.

2.6 Mortgage Risks

In mortgage financing, having various customers from different backgrounds exposes a lot of risk to both the borrower and the lender (Scanlon, Lunde, & Whitehead,

2008). The major risks include Credit risk (default risk) that is default on loan obligations and investment risk where the owner-occupier value of the home will fall, and with it the value of the owner-occupier's equity (Lewis & Neave, 2008). Furthermore, J.Lea (1990), defines default risk as that brought about when the market value of the property falls below the market value of the mortgage. Further, Interest-rate risk to either party where the interest rate will move against them and prepayment risk, which involves the borrower repaying a loan (particularly a fixed-rate loan) before the end of its term. In Uganda, real estate is also faced with occupancy risk.

2.7 Mortgage Pricing

According to J.Lea, 1990, mortgage prices are principally determined by real interest rates and risk factors specific to mortgage instruments. Different from the above, mortgage rates are determined basing on inflation rates, nominal rates and housing prices (Tsatsaronis & Zhu, 2008). It's important to note however that both scholars bring out the possibility of risk as being a determinant of mortgage prices. There are two basic methods for pricing mortgages namely cost-based and market –driven approach (Meidan & Chin, 1995). Cost-based which is widely used involves calculating both direct and indirect costs for a mortgage, and a profit element is added to the total costs (Avlonitis & Indounas, 2005). The main advantage is that, if cost structures are known, the pricing task becomes simplified.

Market-driven pricing is based on the market price for the service, which is the overriding factor. This is generally used in highly competitive environments where many mortgage-lending players are offering similar services (Meidan & Chin, 1995). There are two methods in this category: competitive pricing and differential pricing. Competitive pricing describes a situation in which the price is set according to what the market leader is charging. Differential pricing takes into account the ability and willingness of the market segments to pay.

2.8 Loan Default and Bad Debt

Default is described as failure to fulfill a legal obligation to which one has agreed to in the past. It is anticipated in lending activity. Moreover Adewunmi (1982) enumerated causes of default to include; poor analysis of financial data, incomplete knowledge of customers activities, bad management of account, inadequate monitoring, misrepresentation and dishonesty of customer, excessive lending on security value, insensitive to economic and environmental trends, diversion of funds and inadequate project funding.

2.9 Benefits of Mortgages in Uganda

Invalid source specified.

- a. Enhance acquisition of affordable housing with the option to own your home and pay for it in affordable installments over time.
- b. The sector creates employment,
- c. Improves standards of living,
- d. Creates ability to plan and manage cash flow with ease.
- e. Offers growth in household savings and wealth, government revenue and development of the capital markets.

- f. Increases production, transfer and maintenance of housing contribute notably to national economy.
- g. Contributes to Gross Domestic Growth (GDP) through fixed capital investment and housing services, which include the value of new construction, improvements and additions to existing units.
- h. Housing services are provided which include rent payments and imputed rent to homeowners.
- i. Provide good collateral that is they are usually the lowest ways for households to finance general borrowing for consumption, non-housing investment or business formulation.
- j. Housing investors use leverage to increase returns on investments as well as diversify their investment opportunities.
- k. Mortgage financing has a stronger effect on consumption expenditures than do other forms of savings.
- l. House-price increases can lead to stronger increases in consumer demand than do rising stock markets, with the result that housing market trends may be more closely related to overall macroeconomic cycles.

As mortgage markets deepen, there are greater opportunities for households to access this wealth. In particular, the ability to refinance allows families to spend the capital gains realized on rapid house-price increases.

2.10 Inflation and Mortgage Financing in Uganda

In 2011, the Central Bank shifted the inflation targeting by increasing the Central Bank Rate from 13% in July to 23% in November as announced by Louis Kasakende, Deputy Governor Bank of Uganda. Commercial Banks pay an interest rate of 4% points including the Central Bank Rate when borrowing from the Central Bank. Commercial banks have duly passed on the interest rate burden to their customers. This has increased the number of mortgage defaults. Given the long-term nature of mortgages, depending on the different interest rate environment, defaults will reduce the gross tenure of bank assets. A high default rate will thus increase the risk of lending on a long-term basis and compel banks to revert to short-term lending, which would tend to negate a major goal of the current CBR policy to reduce short-term bank assets.

2.12 General Prospects of the Mortgaging Sector

The mortgage market development in Uganda has been stifled for a long time. Banks have since been pre occupied with investment in high yield government debt, large and high quality corporate accounts and consumer loans with short maturities which led to mortgage debt outstanding to be about seventy million in the economy. The rampant rural urban migration has increased demand for decent houses at all levels. By 2035 the housing needs for Kampala alone is projected to be 1,018,000 units. There is huge demand for mortgage financing in the country today.

2.13 Real Estate as security

When considering real estate for security, Brueggerman & Jeffrey (2002) opined that property market value is the basis for lending decision because it will either be full or partial security for loan. Osayameh, (1986) however affirmed that when taking a mortgage over business premise for a large advance, it is prudent to use professional

valuers because of the technical intricacies involved in asset valuation. When real estate is lodged as security for loan, certain elements have to be considered which include, valuation report of the property by a competent valuer, insurance, the title examination and report, the mortgage creation, legal or equitable, the priority of charge required, repayment of loan, remedies available to the mortgagor, is there a second mortgage or sub mortgage? And whether the land is registered or not (Onanuga, 1999).

2.14 The Relationship between Mortgage Financing and Real Estate Performance in Uganda

Banks fund real estate through mortgage financing ranging from 60% to 80% of the initial property purchase price and also for development land purchase of existing buildings; they finance construction projects, real estate companies; they lend to non-financial firms based on real estate collateral (David & Zhu, 2004).

The performance of the real estate in a particular country rises in terms of less risk, higher returns and more rental income. These two variables are positively correlated for example in America, residential construction is peculiarly dependent on mortgage loans where almost all one to four-family housing are being bought with the aid of mortgage loans, (Herzog & Earley, 1970) thus tremendous growth in the real estate sector.

Further still, according to D. Tirtiroglu (1997) private investors seek debt financing for real estate assets due to tax benefits and lack of sufficient equity funds. Development in one of them due to improved mortgage facilities, will automatically lead to the improvement in the other. With a poorly developed real estate finance market, firms or households are powerless to mobilize capital tied up in real estate. This denies firms the opportunity to use real estate as collateral for raising investment finance.

2.15 The Gaps in the Mortgage Sector and Real Estate Sector

According to Okwir (2006), the following issues shoe the gap in the industry;

- I. The lack of sufficient long-term local currency liabilities with which to match the mortgages in both domestic banking system and capital markets.
- II. Deprived quality of housing stock, which makes them unattractive to primary mortgage providers and
- III. Poor quality of the existing stock of mortgaged properties, which is a disincentive to the development of a secondary mortgage market.
- IV. Low disposable income of the bulk of the population and therefore their inability to service mortgages.
- V. Major delays at the land registry frustrate financial institutions in their effort to register their interest in the properties.

Lack of trust in the quality of titles discourages potential buyers and mortgage providers.

3. Research Objectives

- 1) The main objective of this research is to study the contribution of mortgage loans to the performance of real estate.
- 2) To determine the feasibility of terms and conditions in accessing mortgage loans.

- 3) To determine the relationship between mortgage financing and real estate performance.

4. Methodology

A quantitative research design using a survey and the target population consisted of all various mortgage beneficiaries from different banks. The study used a sample of 60 beneficiaries from the different banks that offer mortgage loans. The independent variable of this study is Mortgage measured using interest rates, size of the loan and the mortgage terms given while performance of real estate is the dependent variable and it was measured using rental income.

5. Data Analysis

The results of the study were presented with the use of tables and charts to produce trends of the respondents. Techniques such as statistical description and tabulation (SPSS) were used for easy interpretation of the quantitative data within the context of the study.

6. Results And Discussions

The rise in mortgage interest rates and the cost of borrowing as an effect of the increase in the Central Bank Rate has damaged both the financial sector and the real estate sector. It has become

Table 1: Types of mortgages acquired by respondents

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Residential space	29	48.3	48.3	48.3
Office	13	21.7	21.7	70.0
Retail	14	23.3	23.3	93.3
Industrial	4	6.7	6.7	100.0
Total	60	100.0	100.0	

Source: *Primary data*

Table 2: Loan dispensation to customers

	N	Minimum	Maximum	Mean	Std. Deviation
How much loan was granted to you by this bank	60	10000000	60000000	27050000.00	13937420.669
Valid N (listwise)	60				

Source: *Primary data*

The table above shows that the minimum amount of mortgage loan that was borrowed by the respondents was 10,000,000/= and the maximum was 150,000,000/=. The average mortgage loan was 27,050,000/=

Table 3: Repayment period

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 5 years	11	18.3	18.3	18.3
between 5 - 10 years	27	45.0	45.0	63.3
between 11 - 15 years	14	23.3	23.3	86.7
above 15 years	8	13.3	13.3	100.0
Total	60	100.0	100.0	

Source: Primary data

The analysis in Table 9 shows that 11(18.3%) of the respondents had to pay back the loan in a period of 5 years, 27(45.0%) had to pay back within a period between 5 to 10 years, 14(23.3%) had a repayment period of 11 – 15 years. Only 8(13.3%) had a repayment period that was above 15 years. The results indicate that majority of the loans disbursed for real estate developments are to be repaid within 5 – 10 years. This may be attributed to the fear by financial institutions about the unpredictability of the economic stand of the mortgagors within a period above 10 years. They fear to risk into such a long term venture.

Table 4: Respondents opinion about the feasibility of acquiring a mortgage

Statement	N	Agree	Neutral	Disagree
The process of getting a mortgage loan from this bank is simple and short	60	18.3%	15.0%	66.7%
Anyone can qualify for a mortgage as long as you have collateral security	60	3.3%	11.7%	85.0%
Employees of this bank have knowledge and competence to answer your specific queries and requests	60	46.6%	40.0%	13.3%
Mortgage staff are active, skilled and able to take action whenever a critical incident takes place	60	71.7%	10.0%	18.3%
Authorization and approval of a mortgage loan is promptly done in this bank	60	21.7%	23.3%	55.0%
Enough information about mortgage loans is given before applying for the mortgage	60	86.7%	13.3%	-
Bank interest rates are on mortgage loans are favorable	60	18.4%	20.0%	61.7
The repayment period given by this bank is realistic	60	66.7%	20.0%	13.3%
Banks interest rates remain constant for the whole period of the mortgage	60	6.7%	5.0%	88.3%

Source: Primary data

The table above illustrates respondents' opinions about the process of getting a mortgage from their financial institutions. Only 18.3% of the respondents agreed that getting a mortgage from their respective banks was simple and an easy process while half of them disagreed indicating that acquiring a mortgage from most financial institutions has a lot of formalities. Furthermore, 85.0% disagreed that anyone can qualify for mortgage as long they have collateral security compared to only 3.3% who perceive that collateral security (real estate) is the basic need for one to be guaranteed a mortgage. This shows that collateral security alone cannot guarantee someone a mortgage. One has to have other added advantages such as social influence to obtain a mortgage. Regarding the assistance of the workers in the mortgage department, about half 46.6% of the respondents perceive that the employees have knowledge and competence to answer their specific inquiries. 24% were unsure and 13.3% denied this. The analysis further shows that only 21.7% of the respondents agreed to the statement that authorization and approval of a mortgage loan is promptly done. On the other hand, 55% disagreed implying that the approval and authorization process of a mortgage is slow. 86.7% reported that enough information about the mortgage and its terms and conditions is given prior to application. Only 13.3% were unsure if enough information is given. Bank interest rates on mortgages were favorable to only 18.4% and not favorable to 61.7% signifying that majority of the clients found the interest rates high and were constrained. Unfortunately, 88.3% reported that the interest rates tend to rise in the course of repaying the loan. This may be a disincentive for clients to apply for mortgages due to the lack of transparency expressed by financial institutions offering this product moreover majority of respondents 66.7% found that the repayment period given by the banks is realistic for them to pay back the loan.

Table 5: Respondents opinions on real estate performance

Statement	N	Agree	Neutral	Disagree
The real estate sector has been developing in the past five years	60	85.0%	15.0%	-
An increase in the number of real estate developers can improve the level of real estate development	60	93.3%	6.7%	-
Mortgagors have been able to get back what they invested in real estate in terms of rental income	60	48.3%	13.3%	38.3%
The number of people owning houses in Uganda is increasing	60	93.3%	6.7%	-
Rental prices are rising everyday and the profits out of that are increasing too	60	75.0%	11.7%	13.3%
The return from real estate investment is high compared to other businesses	60	35.0%	46.7%	18.3%
It is easy to yield from the real estate business than other businesses	60	45.0%	35.0%	20.0%

Source: *Primary data*

From the above analysis, 85.0% agreed that the real estate sector has been developing in the last five years. 93.3% observed that an increase in the real estate developers

improved real estate development. Regarding rental income, 75.0% agreed that rental prices increase daily as well as profits. 93.3% agreed that the number of people owning houses in Uganda is significantly increasing implying a significant positive performance of the real estate sector. With the level of return from the real estate venture, only 35.0% agreed with the statement that the real estate investment return is high compared to 46.7% who were unsure and 18.3% who disagreed.

Table 6: Responses on contribution of mortgage on real estate performance

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	36	60.0	60.0	60.0
	No	24	40.0	40.0	100.0
	Total	60	100.0	100.0	

Source: *Primary data*

Results show that 60.0% approve that the mortgage scheme funded by the banks has been of significant influence to the performance of real estate sector in the country. This has been achieved through bridging the financial gap between buyers and sellers. The loans have enabled people to purchase their own houses.

On the other hand however, 40.0% of the respondents thought that the mortgages offered by the banks are insignificant. This is justified by the argument that it's a service only maintained in the urban areas of the country and has not catered for the shelter needs of the rural population. The high mortgage interest rate thus discourages mortgage loan acquisition hence rendering the service to be accessible to few eligible potential due to the complicated mortgage processing protocol thus being a deterrent factor. Respondents find that mortgage financing has been of less impact towards improving the real estate sector due to lack of awareness, knowledge, poor perception and attitudes of Ugandans towards financial institutions.

Table 7: The relationship between mortgage loans and real estate performance

		Realestate222	mortgage2222
Realestate222	Pearson Correlation	1	.312*
	Sig. (2-tailed)	.	.015
	N	60	60
mortgage2222	Pearson Correlation	.312*	1
	Sig. (2-tailed)	.015	.
	N	60	60

*. Correlation is significant at the 0.05 level (2-tailed).

Source: *Primary data*

The table above illustrates that there is a significant positive relationship that exists between mortgage financing and Real Estate Performance ($r = .312^*$, $p = 0.015 < .05$). This implies that with increased mortgage finances, there will be increased acquisition of real estate in terms of land and buildings and as a result, there will be improvement in real estate performance in the country. However, the correlation results explain that

the relationship between mortgage financing and real estate performance is weak. Only 31.2% of the variation in real estate performance can be explained by mortgage financing while the other 68.8% can be explained by other factors beyond research scope.

7. Conclusion

Mortgage financing therefore was correlated to performance of real estate. Elements of mortgage financing like mortgage terms and interest was found to be of influence to the performance of real estate. Mortgage terms appeared top priority in which Promptness of the authorization and approval process of mortgage loans, appropriateness of the approval process, bank employee's knowledge and competence to answer customer specific queries and requests should be given more attention to allow easy access to mortgage financing and hence increase in the performance of real estate. However, financial institutions need to bear in mind the need for proper credit evaluation to minimize on default risk yet also provide the services (mortgage finances) in time.

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Collaboration between Architectural and Structural Models

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Abstract

Since more designers adopt Building Information Modelling (BIM), the need for sharing information and collaborating among disciplines have become more and more critical. The key to enhance the communication among design team members is to develop the relation to each other within three-dimensional models and to link the various models of the disciplines that are working synchronously or asynchronously. Once the architectural and structural models have been linked together, they are needed to manage these links and to monitor and deal with changes that occur within these models. This paper examines these issues and attempts to display the collaboration between the architectural and structural models during the design process.

Keywords

Architectural teams, BIMs, collaboration, design process, structural teams.

Introduction

In recent years, building information modelling based design process has become an active research area in order to address problems related to information integration, communication, and interoperability. It is a new way of creating, sharing, exchanging, and managing the information at all stages of the design process basis on collaborative environment. With the rapid development of information and communication technologies, different systems of integration and collaboration technologies have been innovated and deployed during the process of design to support and manage the collaborative environment, to integrate people, information, and processes more efficiently and to use and distribute information through the entire product. To some extent, these technologies provide a consistent set of answers to different application domains, including architecture, engineering, construction (AEC), and enormous benefits have brought to the diverse fields of life. Although the developments seem to be slow in the engineering fields, but they have some touchable impact in various sectors within these fields (Shen et al., 2010).

Widespread adoption and proliferation of object-oriented Computer-aided Design (CAD) tools provide encouraging motives for the sharing and exchange of 3D information. Building Information Modelling (BIM) is playing an important part in the engineering sector. BIM is an advanced approach to object-oriented CAD. Researchers have been investigating the mechanisms and implications of building product models for many years before the rise of Building Information Modelling as a new term (Eastman et al., 2011), Whether the term itself is useful, agreed upon or

disputed, BIM is continuing to spread in both industrial and academic domains (Ibrahim et al., 2004) .

The main aim of the work described here is to improve the collaboration between the structural and architectural teams represented by their building information models (BIMs) during the design process. Elements, which will be highlighted in this paper, have been shown in figure (1). The techniques that have been used for collecting, analyzing and interpreting data are a combination of information technologies and object oriented programming language to investigate, develop and evaluate BIM models to support collaborative design requirements.

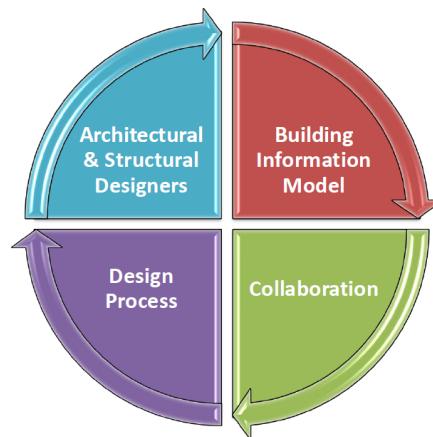


Fig. 1. Elements that will be highlighted in this paper.

Interrelationship of Architectural Design and Structural Design

Architecture and structural Engineering are two different sciences that are interrelated. Structural design deals with the design that helps to keep the structure safety, serviceability, and economy while the architectural design seeks to control aesthetic realistic and practical considerations.

The engineering design is a complicated activity that a lot of designers and experts are involved in this process and there is a large amount of data transfer between them and between each of the design stages. Although this process has been presented as a linear manner, while in practice, designers frequently jump back and forth between design stages. Each designer has a different style based on their knowledge of functional forms and their viewpoint of the importance of functional economy, efficiency and beauty as well as the relation between them (Flager, 2009). Integrated design can be reached when all actors of the project collaborate across various disciplines and agree on far-reaching decisions jointly from conception to completion. Fragmentation nature of the process is a main obstacle in the efficiency and integrity of the design as a whole. This is largely due to the limitations in the use of non-integrated design systems and there is no effective collaborative platform. (Ruikar et al., 2005).

The Architectural and Structural designs have a heavy dependence on information technology systems; the amount of data transferred during the design stages is huge (Tizani, 2011). Different software packages used at each stage of the design process do not necessarily allow for the smooth transfer of data between processes and

disciplines. This generates a high level of re-working on data, such data and information flow leads to a lack of integration between different stages in the design processes and hampers collaborative design (Fahdah and Tizani, 2008).

Information Model

It is a representation of concepts and the relationships between objects, which can formed the data and the information as a model or models.

Building Information Model

In the (AEC) industries, collaboration between disciplinary team has revolved around the exchange of 2D drawings and documents. Although the separate designs have been using 3D models and visualization applications, but until recently collaboration practices have remained more or less 2D-based (Wu and Hsieh, 2012) . Use and spread of object-oriented CAD packages and increase the level of automation in the construction process encouraged the exchange of 3D data in the collaboration process. Building Information Modelling (BIM) is playing an important role in this transformation (Singh et al., 2011) . The information available on BIM is different in the level and type of information that available from traditional design tools. In traditional CAD, slab or any other elements are an assemblage of lines that define the geometry of that slab. In BIM, the slab is an object that holds a wide set of information. In addition to the physical dimensions, BIM is a parametric model contains information about how the element is related to the design in general and to other elements (Autodesk, 2012) , this allows the model to adjust to design changes to match without change each single element (Eastman et al., 2011). Succar (2009) classified BIM according to the richness of the model into four stages, as shown in figure (2): Pre-BIM Status represents the 2D CAD and 3D visualizations, Object-based Modelling, Model-based Collaboration, and Network-based Integration.

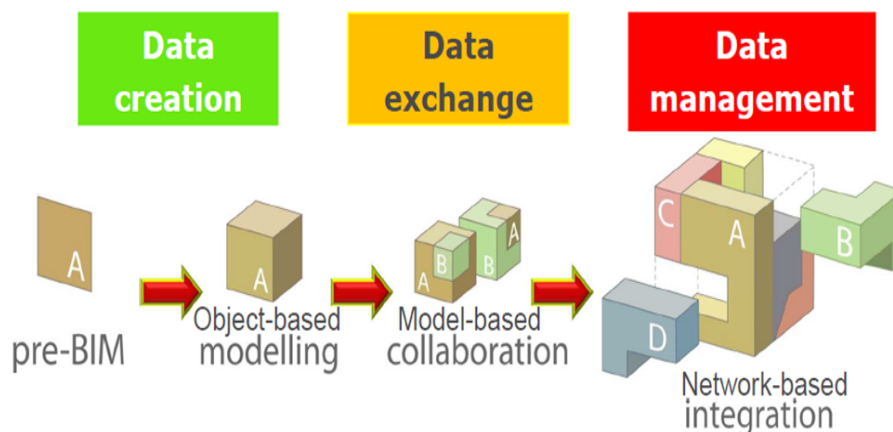


Fig. 2. BIM stages as a series of steps (Succar, 2009)

Architectural and Structural Models

Design information requires the same information to be used multiple times by multiple designers. The information models that are used are large, complex, and highly interdependent, and includes different design consultants (Steel et al., 2012). The designers working alongside to upload and maintain the prototype design model

they are received from the architect. This architect's model will modify with the progress of design and each discipline must be warned to ensure that they are working with the latest versions of the model. Models can be created for several designers, as the design develops; changes in structure model must be transferred back to the others (Chang and Shih, 2013) as in figure (3). Mistakes begin to creep into the works when updates are incorrectly done or incompletely, and work can be wasted since designers are working from out-of-date information (Singh et al., 2011). Architectural and structural information models influences the whole range of design stages, from the initial steps of project development, dealing with possibility and concept design, to design development and detailing (Eastman et al., 2011) .

In some references (Ashcraft, 2009, Isikdag, 2012) argued that BIM is a central model while in reality multi-disciplinary designers are working on different information models depending on the specialization of each one of them. Structural model prepared by the structural team is different in terms of analysis and design from the architectural model but linked to each other's in terms of the technical specifications of the elements and the relationship between these elements.

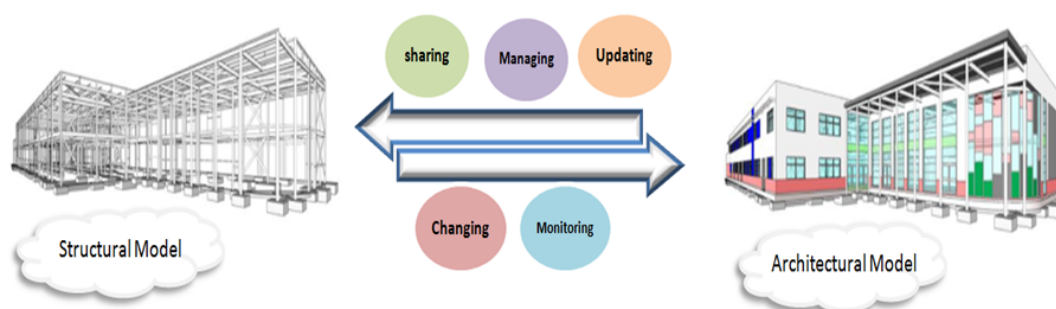


Fig. 3. Transferred information between structural and architectural models

Challenges to implementing BIMs and integrated design

BIM has serious implications for the design process, every designer is different and has his own unique process, and this is one of the biggest challenges to implementing BIMs. There are some difficulties to manage different models during the design process; some of them are related to the social part, about people and process, the engineer's backgrounds and their specialties and the complexity of the work. Others related to the technical part, about technology, there are no efficient ways to exchange information among the designers (Tizani and Mawdesley, 2011). Moreover, nonexistence of an effective collaborative platform, Deutsch (2011) clarified twelve obstacles to successful adoption of and collaboration in BIM and integrated design as shown in figure (4).

Government BIM Strategy

The UK construction industry is the sixth largest industry in the UK; it represents £ 110bn per annum of expenditure. There is a widespread acknowledgement across government that the UK does not get full value from the construction industry. (Cabinet-office, 2011). Based on BIS (2011) report, government and construction industry are collaborating closely to achieve structural change , the roadmap and strategy of the government are to restructure Government/Construction sector outlook

to enable the progressive use of collaborative BIM working on all government building programs by 2016 , as well as providing a framework for exchanging information and delivery standards. In figure (5), BIM maturity levels have been planned to ensure clear articulation of the standards, the relationship with each other and how they can be applied to projects in the industry, it is being used at the moment at a number of different levels of sophistication (Ngo, 2012) . According to Bews (2012) , only 15% of the projects currently use level 2 BIM and the remaining still at level 1 or less . Therefore, there is a lot to be done to increase the awareness and use of BIM across all sectors of the construction industry.

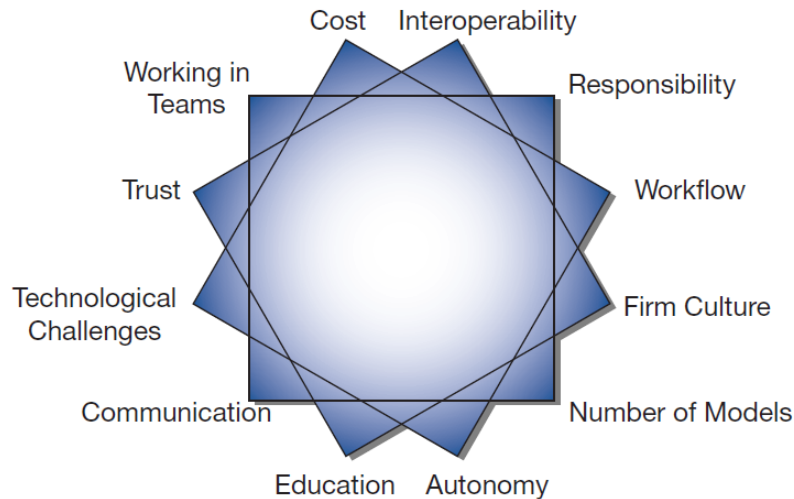


Fig. 4. Different obstacles to successful adoption of and collaboration in BIM and integrated design. (Deutsch, 2011)

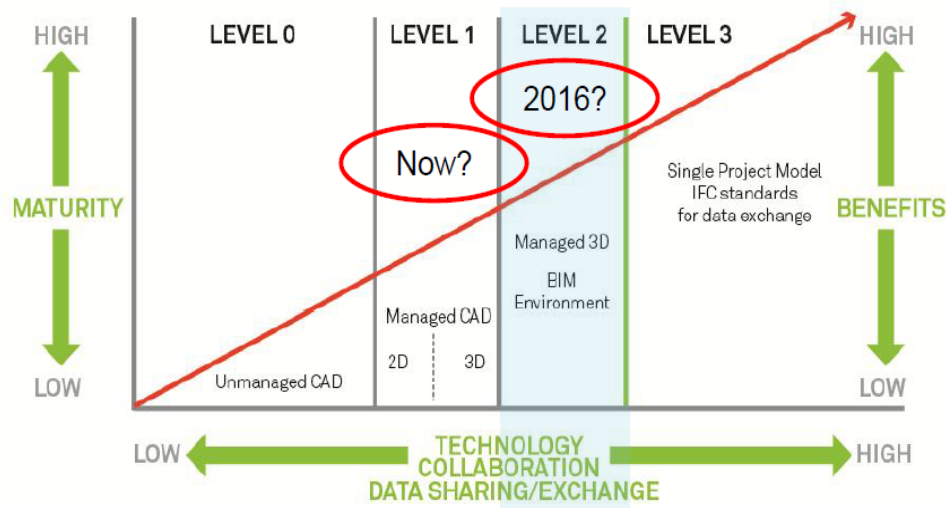


Fig. 5. BIM maturity levels (Bews, 2012)

Compare Two Information Models

Enhancing the communication between design team members requires developing the relationship between each other within three-dimensional space and link the various information models of the disciplines. Once the two information models have been

linked together, it is needed to manage these links and to monitor changes that occur within these models, for example, structural engineer needs to know at any time architect makes changes to his model that may affect his structural model, and vice versa. Of course, during the progress of the work, they will probably receive further updates from each others. Any designer not only needs to be alerted to these changes, but also to be able to respond appropriately by the rejection, approval, or postponed these changes.

A case study has been proposed to help understanding the integration of BIM on the building design. It is based on using Autodesk Revit software to build and compare two information models (architectural and structural models) for the same project. The structural model, which is a reference model based on the architectural model, has been modified according to the requirement of the design, a 1000 mm in a one line of columns have been shifted to make a change in the model. The comparison is based on creating a standard file format (IFCs) for each model and converting the IFC code into a software application prepared by using programming language C# to read line by line the IFC code and present the geometric and non-geometric properties of each IFC element, as shown in figure (6) below.

Columns						
	Id	X-coord.	Y-coord.	Z-coord.	Length	Type
1	150902	-6605.481	9139.660	0	3000	UB838x292x176
2	151024	-1605.481	9139.660	0	3000	UB838x292x176
3	151091	-1605.481	3139.660	0	3000	UB838x292x176
4	151156	-6605.481	3139.660	0	3000	UB838x292x176
5	154644	-6605.481	9139.660	3000	3500	UB838x292x176
6	154748	-1605.481	9139.660	3000	3500	UB838x292x176
7	154831	-1605.481	3139.660	3000	3500	UB838x292x176
8	154912	-6605.481	3139.660	3000	3500	UB838x292x176

Beams						
	Id	X-coord.	Y-coord.	Z-coord.	Length	Type
1	151318	-6605.481	9139.6605	3000	5000	UB305x102x25
2	151343	-1605.481	9139.6605	3000	6000	UB305x102x25
3	151369	-1605.481	139.66057	3000	5000	UB305x102x25
4	151392	-6605.481	3139.6605	3000	6000	UB305x102x25
5	155045	-6605.481	9139.6605	3500	5000	UB305x102x25
6	155075	-1605.481	139.66057	3500	5999	UB305x102x25
7	155093	-1605.481	3139.6605	3500	5000	UB305x102x25
8	155113	-6605.481	3139.6605	3500	6000	UB305x102x25

Fig. 6. The output of reading IFC files.

The principal benefit of IFC object – oriented file format is its object description. Not only the IFC contains the full geometric description, but also knows object location and relationships, as well as all the parameters of each object. It is important to consider what type of information should be present and which change in models should be highlighted. Figure (7) shows all the building information are needed to compare the models and identify any new, deleted and modified elements at each model.

Form1

Read IFC Files Comparison Analysis

IFC file 1 Comparison IFC file 2

Columns

Id	X-coord.	Y-coord.	Z-coord.	Length	Type
151002	-6605.481	9139.660	0	3000	UB838x292x176
151024	-1605.481	9139.660	0	3000	UB838x292x176
154644	-6605.481	9139.660	3000	3500	UB838x292x176
154748	-1605.481	9139.660	3000	3500	UB838x292x176

Beams

Id	X-coord.	Y-coord.	Z-coord.	Length	Type
151318	-6605.481	9139.6605	3000	5000	UB305x102x25
151343	-1605.481	9139.6605	3000	6000	UB305x102x25
151392	-6605.481	3139.6605	3000	6000	UB305x102x25
155045	-6605.481	9139.6605	3500	5000	UB305x102x25
155075	-1605.481	139.66057	3500	6999	UB305x102x25
155113	-6605.481	3139.6605	3500	6000	UB305x102x25

IFC file 2

Id	X-coord.	Y-coord.	Z-coord.	Length	Type
150902	-6605.481	10139.66	0	3000	UB838x292x176
151024	-1605.481	10139.66	0	3000	UB838x292x176
154644	-6605.481	10139.66	3000	3500	UB838x292x176
154748	-1605.481	10139.66	3000	3500	UB838x292x176

Id	X-coord.	Y-coord.	Z-coord.	Length	Type
151318	-6605.481	10139.660	3000	5000	UB305x102x25
151343	-1605.481	9139.6605	3000	7000	UB305x102x25
151392	-6605.481	3139.6605	3000	7000	UB305x102x25
155045	-6605.481	10139.660	3500	5000	UB305x102x25
155075	-1605.481	139.66057	3500	6999	UB305x102x25
155113	-6605.481	3139.6605	3500	7000	UB305x102x25

4.11.1 Fig. 6. The output of comparing IFC files.

Conclusion

Architectural designs and structural designs are meaningless without each other. They are a combination of creativity and technicality. This research has clarified the relationship between the architect and the structural engineers through improving the collaboration between their building information models (BIMs) during the design process. Architectural and structural designs have a great dependence on information technology; BIM deals with objects that hold a wide set of information besides the relationships among the elements. IFC represents BIM for sharing data across various applications used in the AEC sector.

A compatibility between the IFC files of building components are investigated by comparing the IFC codes and identifying differences as data. A tool is developed based on object oriented programming (OOP) approach by using C# programming language to read, analyze and compare the data for each element in the IFC files. The outcome of the comparison gave us some understanding to share the changes in different models among multi-disciplinary designers, identify the similarity and differences among them and extract the required data from the information models.

In the future goals, the idea of collaboration between structural and architectural models will be extended through integrating applications into Revit software. The Revit .NET API allows users and application developers to program with any .NET compliant programming language to gain access to model graphical data and model parameter data, create, edit, and delete model elements and import external data to create new elements or parameter values.

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The History of Urban Regeneration in the United Kingdom: A Case Study Example Showing the Lack, and Subsequent Need of a Generic Measurement Framework

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Abstract

This paper explores the history of Urban Regeneration in the United Kingdom and highlights a well publicised area of Salford as a case study example. The resulting MediaCityUK has been hailed as a success through attracting major broadcasting operations, such as the BBC and ITV, to rehouse aspects of their business to the North West of England. The question is then posed as to how success or failure in Urban Regeneration can be measured, as other factors usually associated such as local employment or crime have not been reported on. Further, can the success or otherwise of differing regeneration areas be compared? Thus, further research is required to explore the need for a generic regeneration framework.

Keywords

Case Study, Framework, Measurement, Urban Regeneration.

Introduction: History of Urban Regeneration

There has always been a necessity to renew and renovate. A good example within the last century would be Europe's rebuilding after the Second World War. The UK is still smarting from some of the key governmental decisions taken during that period, when buildings were thrown up and neighbourhoods and estates were created, through necessity, very quickly, without any planning, partnership or consultation (Stone 2003). "Repent at leisure" is the saying, and unfortunately that has come true in many areas. Persistent poverty was a key feature in many of these areas. The fact that poorer immigrants from the former British Empire were housed in mainly inner city areas, compounded inner city urban poverty (Atkinson and Moon, 1994). Large amounts of immigrants were forced to take low paid, unskilled jobs and had to find cheap accommodation in inner city areas (Tallon 2009). It was in response to this urban poverty that the former Prime Minister Harold Wilson created the "Urban Programme", an urban policy for the United Kingdom (Tallon 2009). The idea of Urban Regeneration as an explicit strategy was imported from the US and this signalled the start of a new era of public and subsequently private intervention to try and solve some of society's biggest problems (Johnstone and Whitehead 2004).

Urban Regeneration has evolved over the past sixty years. Roberts (2000:14) categorised the main themes involved in the evolution of Urban Regeneration in the United Kingdom from the 1950s through to the 1990s.

The 1950s were preoccupied with post war reconstruction and were seen as a period of dramatic suburban growth on new UK council housing estates. Relocation of industry resulted in severe decline of inner city areas (Tsenkova 2002). Towns and cities were based primarily on a master plan and suburban growth and at that time, received only minimal intervention from the private sector (Roberts et al 1999).

The 1960s continued with much of what was utilised in the 1950s, with the 1950s theme continued and some attempts of rehabilitation added. The State planning system was considered as incapable and inefficient (Barnekov et al 1989) but nevertheless Urban Regeneration did tend to be public sector driven and was concerned primarily with the large-scale development of inner city slum areas (Couch 1990).

The 1970s in the UK focused on in situ renewal and neighbourhood schemes, together with suburban development. There was also a “shift in emphasis” regarding the physical or “bricks and mortar” approach to regeneration (Tsenkova 2002). Harding and Garside (1995) state that in the late 1970s there was a focus on economic goals such as large scale infrastructure redevelopment, fuelled by increased private sector involvement, such as the London Docklands. Indeed, Thornley (1993) adds that the advent of the UK Conservative Government in 1979 brought the private sector to the fore in Urban Regeneration.

According to Barnekov et al (1989), urban policy within this decade focussed on four main areas:

- Rising urban poverty, housing needs, low income earners and unemployment
- Long term unemployment and increasing job loss in inner city areas
- Concentrations of racial minorities in major urban centres
- The causes of decline - as opposed to the symptoms

In the 1980s, major schemes of development and redevelopment, flagship projects and out of town projects were conceived. The “Regeneration Blueprint” of the era was the 1977 White Paper “Policy for the Inner Cities” (Department of the Environment 1977) which concluded that it was the decline of economic establishments that was responsible for the deterioration of the inner city (Deakin and Edwards 1993). There was a realisation that Urban Regeneration could not be carried out to the levels needed without the notion of Partnerships and Partnership working (Tsenkova 2002). The 1980s also hailed the arrival of two broad initiatives which “accelerated the process of Urban Regeneration” and provided the vehicles to create such partnerships (Tsenkova 2002):

- Urban Development Corporations

The remit of UDCs was to bring buildings and land back into effective use, to develop industry and to create an attractive environment for people to work and live in (Berry et al 1993). UDCs were brought about to strategically combat previous public sector driven policies and were classed as “enablers”. By this, it is meant that they were not “bound by local authority plans” (Brownhill 1990; Berry et al 1993) and that certain powers were held by UDCs regarding such facets as the granting of planning permission and compulsory purchase orders (Berry et al 1993). UDCs also had the power to

grant financial aid and were responsible for any infrastructure within a designed area (Tsenkova 2002).

- Enterprise Zones

Enterprise Zones were designated areas free from planning regulations. This, it was hoped, would prove fruitful regarding aesthetic creativity (Berry et al 1993). Enterprise Zones were also able to claim economic incentives and financial allowances (Lawless 1989).

The view of the time was that regeneration was best done by the private sector and that local authorities would be “relegated to a minor role” (Deakin and Edwards 1993).

In the 1990s, a more sustainable, partnership based and integrated approach was adopted with emphasis on the role of communities (Roberts 2000). Imrie and Raco (2003) disagree with this, stating that in the 1980s and 1990s, the approach to regeneration was largely property led. The holistic approach emphasised in the Urban Task Force report, produced by the Department of the Environment, Transport and the Regions in 1999, stressed that urban regeneration should be founded on strong democratic local leadership, public participation and the use of public finance to attract increased private investment. Local and National Government, private industry and local communities began working together in a more comprehensive approach, including social, economic, environmental and physical policies. These policies at the time “became more engaged in the concept of ‘new localism’” (Tsenkova 2002).

Nowadays, urban regeneration attempts to impact upon the economy and employment, economic competitiveness, social exclusion, community issues, vacant and deteriorated sites in cities, new land and property requirements, environmental quality and sustainable development (Turok, 2004, Keles, 2003, Roberts, 2000).

Case Study Example: MediaCityUK, Salford Quays, Salford, Greater Manchester, England

MediaCityUK is a purpose built creative and media development built on Salford Quays in Salford, Greater Manchester. It has been designed to provide a purpose-built home for creative and digital businesses (Salford City Council 2012). The project was initiated when the British Broadcasting Corporation signalled its intent to move its base and headquarters from London to Manchester in 2004. The site was chosen in January 2006 (MediaCityUK.co.uk 2012) and work began on the site in summer 2007. It has been difficult to elicit other such performance parameters for the purpose of the regeneration project, such as employment, economic performance, image or aesthetics.

The area officially opened in 2011 (Salford City Council 2012) however work is still currently being carried out at the site and there is potential to develop up to 200 acres in the future (MediaCity.co.uk 2012). In January 2012, The Peel Group, which owns the site, unveiled ambitious plans over the next 20 years for further phases of MediaCityUK at Salford Quays. Peel is seeking approval from Salford City Council for an additional 459,000 square metres of development, with the longer term aim of creating a new town centre for Salford Quays (Peel Group 2012).

MediaCityUK aims to bring together companies from across the media sector and to establish an international level facility in the digital media and creative industries.

It is to create more than 15,000 jobs and is to provide workspace for 1,100 creative and related businesses (Ozturk et al 2010). However, no such metrics have been published since to confirm that these employment figures have been reached.

The project is iconic, well planned and environmentally friendly, engages with the University of Salford and hopes to meet the diverse needs of future residents. It involves support and partnership organisations such as Central Salford Urban Regeneration Company and the North West Development Agency. The MediaCityUK Public Sector Partner Programme states an emphasis on place, sector and economy and people and communities. Although stating examples of what would be a preferred and valued achievement within each section, and despite having a vision which includes attempting to “maximise the investment and opportunities presented by MediaCityUK to ensure it meets its ambition to become a globally significant media city with visible, long term benefits for the people living and working in Salford, the Northwest and beyond” (Salford City Council 2012), it doesn’t set out any specific aims or needs for the regeneration of the site other than as mentioned above, the providing of a home for the British Broadcasting Corporation on its move to Manchester from London and the attempt to create a new media hub of international standard.

If the premise is taken that MediaCityUK has been a success, because departments within the British Broadcasting Corporation, an internationally renowned channel, and ITV, a world leader in the broadcasting industry, have moved to the site, with other departments and also other channels following, including SIS (Satellite Information Services) (MediaCity.co.uk 2012), and that the MediaCityUK location contains the most technologically advanced studios in Europe (MediaCity.co.uk 2012), it must also be borne in mind that for a regeneration plot of this size, one would think that the purpose of redeveloping the site included more than simply the above. Factors such as local employment, crime reduction etc have not been reported on.

Scientific Measurement:

A review of the literature, including Bowey (1997), Rhodes et al (2005), Roberts (2000), Hemphill et al (2002) and Hemphill et al (2004), which specifically “expressed concern at the lack of intellectual sophistication and rigour in evaluation of regeneration outputs” has identified that there is no standard and coherent way as to the success or otherwise of a regeneration project. The question is therefore posed as to whether regeneration projects have a lack of clear aims and a lack of a standard way of assessment or of reporting performance. The fact that there is no clear or standard way of measuring, comparing or benchmarking the success or lack of success of a given Urban Regeneration project and the fact that no common framework exists proves the need for further in depth research.

Conclusion

This paper has explored the recent history of Urban Regeneration and has provided a regeneration case study example of major proportions, not least in terms of the scale of the project and the shockwaves the BBC move from London to Salford caused. Further, it demonstrated that there is no generic framework for the scientific measurement of Urban Regeneration and this provides a platform on which the author is carrying out further in depth research.

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Adopting Social Computing in the Higher Education in the Gulf States: Conceptual framework

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Abstract

This research sets out to develop a framework for adopting Social Computing (SC) tools and platforms in Higher Education (HE) institutions in the Persian Gulf States in order to leverage teaching and learning processes. Among other things, it reviews the known problems in HE in the Gulf States, best practices for using Social Computing in Higher Education, and the available literature on user acceptance of technology. It then addresses the known problems in HE and identifies the proper SC platforms for solutions with the support of the approved theories of user acceptance of technology. In order to achieve the goals of this study, a set of research methods has been implemented by taking samples from the different HE stakeholders in the Gulf States to collect data about the significant factors that affect user acceptance when using SC in an educational context. The aim of the data collection is to highlight these factors and link them with the behavioral intentions of using SC in HE in order to propose a framework for the effective implementation of SC in HE in Gulf State institutions. Once that aim being achieved, the society benefits more from its individuals and move toward higher levels of education, innovation and development.

Keywords

Framework, Gulf States, Higher Education, Social Computing, User acceptance, Web 2.0.

1. Introduction

In the last two years, the term *Web 2.0* has gained tremendous popularity. Web 2.0 is a term coined to explain the sharing of information on common platforms such as blogs, wikis, social bookmarking sites, microblogging sites, and social networking sites. All these technologies are based on the definition of SC. The impact of SC on businesses is that it keeps the consumer or end user at the center of all communication, and organizations build products and services based on consumer preferences. SC can also produce benefits such as innovation from group thinking and efficiency in gaining knowledge from the correct source.

There are many theories of information systems that aim to understand, in general terms, the attitudes and behaviors of individuals toward using any given technology. Examples include the theory of reasoned action (Ajzen, 1980), which studies the relationship between attitudes and behavior. It suggests that when subjective norms (i.e., perceived expectations) are combined with attitude, it produces a particular

behavior. Another such theory is the theory of planned behavior (Ajzen, 1985), which is an extension of the theory of reasoned action and the technology acceptance model by Davis et al. (1989). Venkatesh et al. (2003) summarized eight such related models and came up with a unified framework that contains factors that are similar in these eight models. The result is the unified theory of acceptance and use of technology (UTAUT). This model identifies performance expectancy, effort expectancy, social influence, and facilitating conditions as major factors that influence a particular behavior. They also added four moderating variables that significantly influence behavior or, in this case, the acceptance of using technology.

Gunther et al. (2009) made significant efforts to understand why and how people use microblogging. They conducted an experiment with four focus groups to select the important factors that play a role in the adoption of microblogging. The factors they considered were based on UTAUT as a theoretical foundation. The results of the experiment revealed eight important constructs that were very decisive in extending the UTAUT model to understand microblogging.

In this paper, it makes logical sense to use the same constructs or factors identified by Gunther et al. (2009) and extend them toward the adoption of all forms of SC in higher education (HE). To accomplish this task, sets of research methods are implemented in two stages to collect information about the important factors that might affect user acceptance when using SC in HE. The research methods include survey questionnaires and interviews. All were conducted with samples from the different HE stakeholders in the Gulf states.

2. Rationale for the current research

As a critically important institution, HE should be leveraged with tools that help maximize its generated value. In the Gulf states in particular, many challenges confront university teachers and students, making it harder to achieve teaching and higher-learning goals. These challenges—and how SC tools can serve as proper solutions—are listed below:

- i. The Gulf states are categorized by Hall and Hall (2001) as high-context-culture societies. As a reflection of the culture, in schools male classes are segregated from female classes. Sometimes male zealots urge female students to cover up, even with the risk of sharp answers. This segregation reduces and sometimes prevents communication between male and female students, which consequently reduces learning and the sharing of knowledge between genders. SC platforms can serve as shared areas for more collaboration and discussion between students. Even for women who dislike being known by male parties—as per the cultural norms in the Gulf region, which make them think it is insulting to be known by others—SC tools can serve as suitable collaboration platforms for them.
- ii. In the previous two decades, research in the Gulf states' higher institutions focused on growth rather than on development of the society itself (Shaw, 1997). Research emphasis in the Gulf institutions has now moved from economic and technical growth to social and cultural development. The SC platforms serve as proper environments for socialization; thus, SC can play a major role in promoting student learning, especially in modern subjects and majors that focus on socialization and culture.

- iii. Twenty-first-century Generation Y (“NetGen”) students prefer to work in teams or in the form of peer-to-peer communication; they also like to be engaged in their learning, and they are more visually and kinesthetically inclined (Conrad, 2004). Many HE institutions in the Gulf states still use old teaching styles, which sometimes makes students feel bored, and consequently they become less engaged. More precisely, Linda Herrera (2006) denounced the inadequacy of HE in the Arab world relative to the fulfillment of students’ social needs. Improving learning and teaching in Gulf HE institutions can be achieved by exploring new learning techniques, fashions, and up-to-date literatures in the different research areas. The SC platforms offer modern learning environments, making it easier for students to join virtual classes and contribute to blogs, wikis, and social websites where they can explore peer posts and learning materials. It helps students become more engaged in their learning.
- iv. Poor research and redundancies in the most attractive disciplines are the two primary structural problems in HE in the Gulf states (Romani, 2009). Research on the Gulf states always focuses on oil and strategic matters, which means the higher institutions lack serious contributions in social development. The online collaboration offered by SC tools can help students by sharing knowledge and prompting new ideas, which is expected to increase innovation in research.
- v. In most Gulf universities, English is the instructional language for the technical disciplines (Shaw, 1997). Shaw observed that although English is widely spoken in the Gulf states, formal writing in the areas of specialization needs improvement. SC tools are fundamentally writing platforms, and they lend themselves to improving foreign language skills. Blogs have been identified as successful environments for enhancing language skills and promoting creativity (Ducate, 2008).

3. Social Computing

The term *social computing tool* refers to any application that supports or fosters group interaction (Owen et al., 2006). There are sets of SC tools for a range of uses. This includes applications for podcasting (Apple iTunes), blogging (weblogs), social networking (Facebook), collaborative content (wikis), social tagging (del.icio.us), multimedia sharing (YouTube and Flickr), and social gaming (Second Life) (Pascu, 2008). The following section introduces the SC applications that seem most suitable for learning and discusses their potential for use in HE. Some of these tools seem to overlap because of their integration or dependency on similar services, but introducing them will show how they can be used in different ways to enhance student learning.

4. Social Computing In Higher Education

The meeting of minds is at the core of higher education, and SC can facilitate this meeting of minds regardless physical proximity. Thus, SC has a high potential for enhancing student learning in HE institutions. It helps make HE services that are linked to the institution more readily accessible and transparent to the different stakeholders of the HE institution.

Many universities reported that, they are using podcasts in education. A number of them have made the content of some courses available to the public through podcasts.

In 2009, for example, Harvard University announced its second year of podcasting the computer science course E-1 Understanding Computers and the Internet; the course had many followers and appeared on the top 100 podcasts on iTunes². Barkley University announced that 30 of its faculty members agreed to clip on microphones to record their lectures and publish them on the Internet as podcasts (<http://itunes.berkeley.edu/>). Through its early initiative, “Duke Digital Initiative,” Duke University distributed 20 GB iPods to all first-year students to use as a learning tool. The plan was to deploy the educational technology, but one of the emerging technologies in their project was podcasting the classroom recordings and field recordings. The University of Washington conducted an online survey for podcasting; the results showed that 70% of students found that the podcasts supported their learning and were very helpful in studying for exams and preparing homework (Bell, 2007).

Nicole Ellison³, a lecturer in an HE in the U.S., has used Facebook as teaching tool. She pointed out that Facebook made the subject more convenient and easily accessible for the students. She commented that Facebook provides a more engaging learning environment and enhances the peer-to-peer social component (Redecker, 2009)

Second Life⁴, Entropia Universe⁵, Dotsoul Syberpark⁶, and Active Worlds⁷ <http://www.activeworlds.com/> are all examples of virtual environments on the Internet. Second Life managed to attract millions of “active residents” and is still experiencing rapid growth (Pascu, 2008). In March 2007, about 500 universities and research centers, plus 2800 educators, were using Second Life (Calongne, 2007).

The New Media Consortium (NMC) conducted a survey in 2007 about using Second Life in education. The survey was taken by 209 educators who already used Second Life in their classes, and they reported multiple uses of it for educational purposes (NMC, 2008). Sixty percent of the surveyed educators had taken a class in Second Life, 51% had done activities such as supervising class projects on Second Life, 58% were planning to teach classes on Second Life, 50% were using it for class meetings, 46% were conducting research, 47% conducted their office hours virtually on Second Life, 34% provided student services and support activities through Second Life, 34% were mentoring student research projects, 8% had taught a class entirely through Second Life, and 19% were planning to teach a course through Second Life.

Respondents expressed that they saw a high potential for deploying Second Life—and 3D virtual environments in general—in HE (94%). Eighty-seven percent saw significant use of Second Life in simulation and scenario activities. Eighty-six percent saw it as effective in artistic expression; 78% in group work, collaboration, and meetings; 74% in distance learning; 73% in team building; 68% in professional development; and 60% in teaching full courses.

An example of providing an online e-learning environment supported by virtual reality is an open-source project that integrates Second Life and Moodle into a new

² <http://computerscience1.tv/2011/spring/>

³ <http://nellison.blogspot.com/2007/12/ecar-facebook-as-teaching-tool.html>

⁴ <http://secondlife.com>

⁵ <http://www.entropiauniverse.com>

⁶ <http://www.dotsoul.net>

⁷ <http://www.activeworlds.com>

educational platform called Sloodle⁸. Sloodle aims to develop a sound pedagogical model for teaching in web-based 3D environments with all the features of the learning management systems; this is expected to make teaching easier and achieve higher rates of learning.

There are many other examples of educational social computing applications that were started as initiatives at some universities and are now available for free as open-source platforms. San Francisco-based initiative Wikispaces⁹ is one example; it started in 2006 and provides thousands of wikis for free to serve educational purposes (Geser, 2007). Escribamos is another example of social computing software designed for education. It was developed by Calliope, a Belgian multilingual online writing center, and it works as collaborative writing environment and provides tools for creating e-portfolios (Opdenacker, 2007). Another example is MASSIVE, which is a peer-review service for universities (Attwell, 2007). The learning activity management system LAMS is another example; it was developed in the U.K. to provide several Web 2.0 tools for collaboration between students and educators (Aliyev, 2007).

5. The Unified Theory Of Acceptance And Use Of Technology (UTAUT).

Many theories and models that study user acceptance of technology have evolved over the last few decades. Al-Qeisi (2008) highlighted nine of these models as the base for the acceptance of web-based technologies and systems. Each one of these models defines certain constructs as the factors that affect user acceptance of technology. These models include the Theory of Reasoned Action (TRA), which evolved as a contribution of psychology to the field of technology acceptance (Ajzen and Fishbein, 1980). TRA was extended to form a newer model called the Theory of Planned Behavior (TPB; Ajzen, 1985). This model has in turn been extended to form a model called the Decomposed Theory of Planned Behavior (DTPB; Taylor & Todd, 1995). As a contribution of information systems to the field of technology acceptance, the next new model, called the Technology Acceptance Model (TAM; Davis, 1986) was introduced as another extension of the Theory of Reasoned Action (TRA) and it also had an extension, TAM2 (Venkatesh & Davis, 2000). In addition to these, there is Roger's Diffusion of Innovations model (DOI; 1983), Bandura's Social Cognitive Theory (SCT; 1989), Deci & Ryan's Motivational Model (MM; 1985), and Triadis's Model of PC Utilization (MPCU; 1979). All of these models together were aggregated by Venkatesh et al. (2003) who noticed that information system researchers were confronted with either choosing among the range of the aforementioned models that included a mix of different constructs or choosing one of them and consequently ignoring the constructs of the others. So, they worked on unifying the views on technology acceptance into one model, which includes the most important constructs. They reviewed and compared the most dominant models for explaining technology acceptance behavior. These models included TRA, TPB, TAM, combined TAM - TPB, DOI, SCT, MM, and MPCU. Venkatesh et al. reported on the moderating variables that were studied during the previous research for these eight models. These factors included experience, voluntariness, age, and gender. Then, the authors examined commonalities among models and found seven constructs to be significant, direct determinants of intention or usage in one or more of the individual models.

⁸ <http://www.sloodle.org/>

⁹ <http://www.wikispaces.com>

They reviewed the user acceptance literature and compared the different models to summarize those attitudes; computer self-efficacy and anxiety are hypothesized not to have a direct effect on behavioral intention. However, the following four constructs were hypothesized as playing a significant role and being a direct determinant of user acceptance and usage behavior. These four constructs are performance expectancy, effort expectancy, social influences, and facilitating conditions. The relationship among these constructs is shown in Figure 1-0.

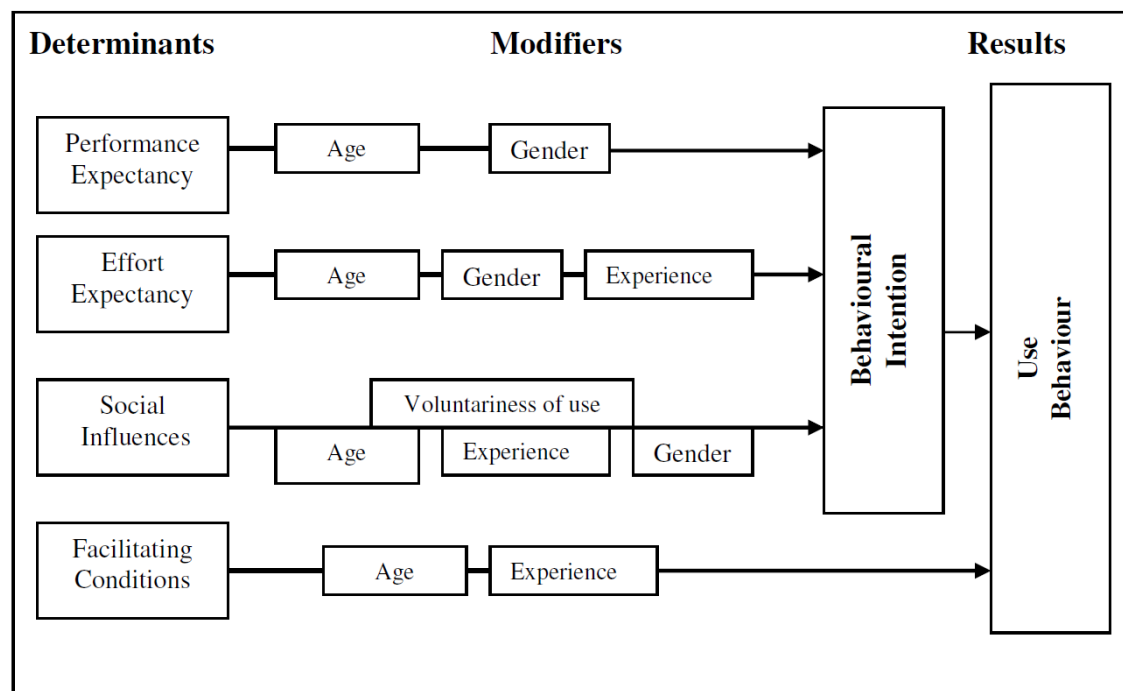


Figure 1-0: UTAUT, Source: Venkatesh et al. (2003)

The constructs in the model were defined and related to similar variables in the eight models as follows:

- Performance Expectancy (PE) is the degree to which individuals believe that using the system will help them attain gains in job performance. Based on the literature, the influence of performance expectancy on behavioral intention is hypothesized to be moderated by gender and age; such an effect would be stronger for men, particularly younger workers.
- Effort Expectancy (EE) is the degree of ease associated with the use of system. Based on the literature, the influence of effort expectancy on behavioral intentions is hypothesized to be moderated by gender, age, and experience; such an effect would be stronger for young women and older workers at early stages of experience.
- Social Influence (SI) is the degree to which individuals perceive that important others believe they should use the new system. Equally, based on the literature, the influence of social influences on behavioral intentions is hypothesized to be moderated by gender, age, voluntariness, and experience; such an effect would be stronger for women, particularly in mandatory settings in the early stages of experience.

- Facilitating Conditions (FC) *is the degree to which individuals believe that an organizational and technical infrastructure exists to support use of the system.* Based on the literature, when both performance expectancy and effort expectancy constructs are present, facilitating conditions become insignificant; and consistent with TPB/DTPB, facilitating conditions are also direct antecedents of usage (an attribute found also in MPUC). This effect is expected to increase with experience in using the technology as users find multiple avenues for help and support. Hence, the influence of facilitating conditions on usage is hypothesized to be moderated by age and experience; such an effect would be stronger for older workers, particularly with increased experience.

Problem Statement And Research Questions

The key problem statement of this research is understanding how effectively SC can be adopted in the HE institutions in the Gulf States to leverage teaching and learning processes and, in due process, achieve higher business value. This leads to identifying the following two research questions:

- How effectively can the SC tools be used in HE?
- What are the drivers of implementing SC in HE?

Answering these questions will lead to developing a new framework that defines how SC can be effectively deployed in HE in Gulf States institutions.

Research Design – Methods And Procedures

The data collection stage included a survey questionnaire that was answered by a total of 389 participants across the two organizations in the case study. This included 249 students, 52 instructors, 39 management staff, and 49 observers. The respondents communicated through frequent emails with links to surveys and through face-to-face requests during classes after receiving permission from their instructors. The researcher sent reminder emails to the targeted respondents to remind them about the questionnaire.

The respondents who were nominated were from the different HE institutions and included students, instructors, administrative staff, and observers. The majority of them were students and instructors who represented the main users of SC in an educational context. The respondents were identified by the case study organization to cover all grade levels, different majors, and different Gulf State nationalities.

The descriptive analysis of the applied research instrument revealed the characteristics of the surveyed sample in terms of:

- IT background and years of experience in using web technologies;
- the culture or country of origin;
- demographics; and
- experience in using the SC tools and technologies.

The collected data will be analyzed and discussed to extract the most important factors that play major role in determining the user acceptance of using SC in HE, and encourage or discourage them to use the SC tools for facilitating the learning and teaching processes. After this stage, the analysis of all the studied factors ends by developing new framework for implementing SC in the HE institutions in the Gulf

States. The framework provides conceptual model of how SC can be implemented in HE to leverage the teaching and learning processes.

Data Analysis

Prior to analysis, the survey responses were examined using SPSS statistical software for accuracy of data entry, missing values, normality, and outliers. Routine descriptive statistics procedures were carried out using the descriptive analysis tools in SPSS. The missing data were below 5% for the collected answers. Hence, they were replaced by the mode value (Schumacker & Lomax, 2004; Hair et al., 2006). The findings of these statistics for the four user samples are presented below.

Analysis of the collected data on the use of internet and SC

The following lists the statistics of the collected data to highlight important characteristics of the surveyed samples on the side of using SC services:

- The level of experience in using Internet and computers showed that all the samples use the Internet more than 10 hours per week (97% of surveyed users). Most of them (98%) have e-mail accounts, and 75% have used the Internet for more than one year.
- The demographic analysis of the surveyed samples showed that 72% were male and 28% were female (represented in Figure 1.1).

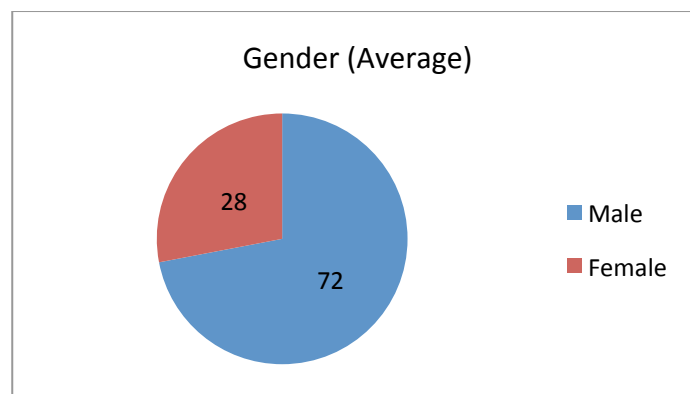


Figure 1.1: Respondents by Gender

- The surveyed samples included 133 respondents from United Arab Emirates (UAE), 177 from Qatar, 39 from Oman, 12 from Bahrain, and 28 from non-Gulf countries. This means that 92.9% were Gulf citizens, and 7.1% were of non-Gulf nationality but living in the Gulf either to study or work. Hence, all sample members were aware of the Gulf states' cultural norms. The two ratios are represented in Figure 1.2.

An essay question about recommendations for enhancing the SC websites' services reported the following suggestions:

- More social activities that support educational motivation are needed.
- The search tools on the SC websites, especially for learning content, could be enhanced to facilitate research activities on these sites.
- The online content of the SC websites needs to be enhanced by compressing it into more lightweight packages. This would facilitate faster browsing and downloads.

- Extend the social websites to integrate with educational websites.
- Add more gaming content.
- All social networks should be free-of-charge services.
- There should be more enhanced security and privacy.
- Integrity matters a lot and should be considered in the newer versions.
- More education-oriented communities should be developed.
- Smoother video calling is needed.

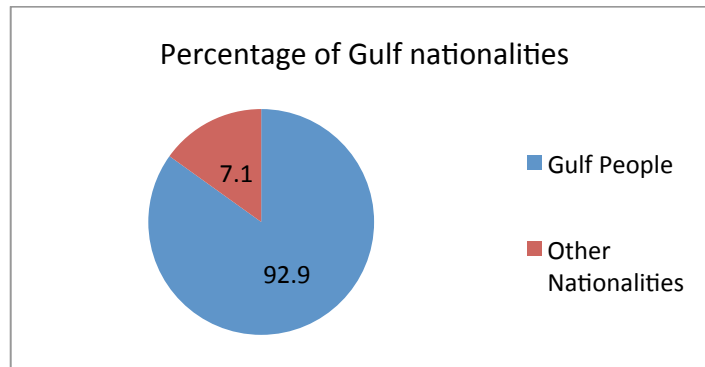


Figure 1.2: Respondents by Nationality

Analysis of the collected data on the technology use factors

Here we analyze and discuss the collected data about the acceptance of using SC in HE in the Gulf states. This includes an analysis of the collected data from the survey questionnaire. The survey included set of questions on every use factor of the studied factors in this research; the factor was either newly constructed or constructed from the UTAUT model. Table 1.1 displays the studied factors of technology acceptance with the factor-question relationship. For instance, questions 3 and 4 were offered to collect user opinions about the significance of “reputation” as a usage factor. Similarly, questions 5 and 9 were offered to collect user opinions about the significance of “expected relationships” as a usage factor.

Table 1.1: Hypothesized Factors – Related Questions

Use Factor	Related questions
Reputation	Questions 3,4
Expected Relationships	Question 5,9
Communication Benefits	Question 6,12
Signal-To-Noise Ratio	Questions 7,8
Codification Effort	Questions 9,10
Privacy Concerns	Questions 11,12,13
Collaborative Norms	Questions 14,15
Facilitating Conditions	Questions 16,17,18

Every question in the survey had 5 options from the Likert scale for the respondent to choose from. Each option was assigned a value as shown in table 1.2. The initial survey was altered many times and translated into Arabic to ensure easy

understanding of its questions; it was checked to see if some questions could be eliminated or merged. For each factor, the offered questions were titled Reputation1, Reputation2, Facilitating Conditions1, Facilitating Conditions2, and Facilitating Conditions3, where Reputation1 means the first question on the “Reputation” factor, which is defined as question 3. Similarly, question 4 represents Reputation2 and so forth.

Table 1.2: Survey measures

Strongly Agree	5
Agree	4
Neutral	3
Disagree	2
Strongly Disagree	1

The first step of data analysis included testing the correlation between the different questions to ensure correlation between the different variable dimensions. The results of correlation confirmed strong links between the different questions of the same variable. Table 1.3 shows the correlation testing results.

The correlation numbers in Table 1.3 prove that the different questions on the same factors successfully test the factor. For instance, there is a correlation level of 0.623 (62.3%) between “Signal To Noise1” and “Signal To Noise2.” Similar findings are between the other factors’ questions. Using SPSS, custom tables have been developed to express the whole dimensions based on the survey measures that are illustrated above in table 1.2. Table 1.4 below shows the results.

The results in Table 1.4 show the level of agreement between the respondents on each factor significance level in affecting the user acceptance of using SC in HE. For example, 275 (55.7%) of the respondents strongly agreed on reputation as an important factor in accepting SC in HE. While 131 (26.5%) agreed on that, 80 (16.2%) were neutral, 4 (0.8%) disagreed, and 4 (0.8%) strongly disagreed. In table 1.5, the percentage of optimism defines the average of the extent to which individuals agree or disagree with a particular statement in the questionnaire. Optimism is expressed by the “Strongly Agree” and “Agree” answers. The mode identifies the response that was received the most number of times. Table 1.5 illustrates the results from the analysis of all the received responses of the survey regarding the factors that affect user acceptance of using SC in HE, grouped by user category. It was observed that the clear revelation from all responses is that, for the most part, they were consistent across all the surveyed samples (students, instructors, staff, and observers).

Table 1.3: Correlation testing results

Question / Dimension	Reputation1	Reputation2	Expected Relationships	Communication Benefits	Signal To Noise1	Signal To Noise2	Codification Effort1	Codification Effort2	Privacy Concerns1	Privacy Concerns2	Privacy Concerns3	Collaborative Norms1	Collaborative Norms2	Facilitating Conditions1	Facilitating Conditions2	Facilitating Conditions3
Reputation1	1.00	.610	.597	.507	.029	.463	.459	.553	.647	-.054	.211	.609	.637	.555	.604	.351
Reputation2		1.00	.567	.558	-.028	.521	.410	.488	.391	-.033	.175	.471	.515	.576	.467	.390
Expected Relationships			1.00	.492	-.001	.571	.379	.534	.499	.022	.153	.520	.511	.468	.494	.515
Communication Benefits				1.00	-.097	.581	.347	.573	.419	.035	.136	.561	.504	.560	.426	.430
Signal To Noise1					1.00	.623	.119	-.015	.081	.639	.583	.004	.014	.011	.166	.180
Signal To Noise2						1.00	.372	.549	.409	.085	.155	.532	.561	.526	.516	.421
Codification Effort1							1.00	.459	.554	.031	.290	.425	.516	.484	.459	.316
Codification Effort2								1.00	-.047	.034	.143	.581	.605	.634	.530	.450
Privacy Concerns1									1.00	.582	.616	.618	.692	.636	.549	.416
Privacy Concerns2										1.00	.580	.013	-.044	-.017	.104	.238
Privacy Concerns3											1.00	.155	.180	.179	.316	.317
Collaborative Norms1												1.00	.645	.624	.539	.506
Collaborative Norms2													1.00	.714	.582	.441
Facilitating Conditions1														1.00	.514	.478
Facilitating Conditions2															1.00	.513
Facilitating Conditions3																1.00

Table 1.4: The whole dimensions based on the survey measures

Survey measure →	5		4		3		2		1	
Question/Dimension ↓	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
Reputation1	275	55.7%	131	26.5%	80	16.2%	4	.8%	4	.8%
Reputation2	254	52.2%	144	29.6%	74	15.2%	10	2.1%	5	1.0%
Expected Relationships	228	46.5%	165	33.7%	83	16.9%	5	1.0%	9	1.8%
Communication Benefits	247	50.2%	158	32.1%	68	13.8%	11	2.2%	8	1.6%
Signal To Noise1	104	21.2%	83	16.9%	98	20.0%	160	32.6%	46	9.4%
Signal To Noise2	191	39.1%	174	35.7%	109	22.3%	4	.8%	10	2.0%
Codification Effort1	184	37.2%	169	34.2%	98	19.8%	33	6.7%	10	2.0%
Codification Effort2	199	41.1%	145	30.0%	113	23.3%	20	4.1%	7	1.4%

Privacy Concerns1	222	45.1%	146	29.7%	107	21.7%	8	1.6%	9	1.8%
Privacy Concerns2	107	21.7%	116	23.5%	115	23.3%	110	22.3%	46	9.3%
Privacy Concerns3	111	22.7%	88	18.0%	221	45.2%	58	11.9%	11	2.2%
Collaborative Norms1	219	44.2%	130	26.2%	122	24.6%	13	2.6%	12	2.4%
Collaborative Norms2	200	40.5%	150	30.4%	119	24.1%	12	2.4%	13	2.6%
Facilitating Conditions1	232	47.7%	123	25.3%	112	23.0%	11	2.3%	8	1.6%
Facilitating Conditions2	197	39.8%	189	38.2%	96	19.4%	9	1.8%	4	.8%
Facilitating Conditions3	153	31.0%	221	44.7%	106	21.5%	1	.2%	13	2.6%

Table 1.5: Factor survey analysis-part1

Question	Factors	Students (252)		Instructors (114)		Management (78)		Observers (49)	
		Optim ism	Mode	Optim ism	Mode	Opti mism	Mode	Optim ism	Mode
3	Reputation	89%	5	88%	5	86%	4	88%	5
4		86%	5	84%	4	83%	4	74%	4
5	Expected Relationships	84%	4	84%	5	83%	4	82%	4
6	Communication Benefits	88%	4	76%	4	79%	4	74%	4
7	Signal to Noise Ratio	53%	2	68%	3	74%	2	49%	2
8		88%	4	92%	5	90%	4	94%	5
9	Codification Effort	72%	5	76%	5	74%	4	63%	3
10		88%	5	84%	4	84%	4	82%	4
11	Privacy Concerns	92%	5	88%	4	94%	5	87%	5
12		65%	3	60%	2	75%	3	52%	3
13		68%	3	84%	4	84%	4	63%	4
14	Collaborative Norms	83%	5	90%	4	80%	4	82%	4
15		79%	4	92%	5	76%	3	71%	3
16	Facilitating Conditions	74%	5	74 %	5	77%	5	72%	5
17		49%	4	64%	4	42%	4	52%	4
18		78%	4	92%	5	78%	4	78%	4

Discussion of Findings

Findings from the data analysis of the use of SC question answers

The answers from the first part of the survey (questions 1 and 2) reflected the following general conclusions:

- The high tendency of university-level students and staff to socialize all the time and keep communicating with their peers
- Clear desire to exploit the social networks in getting access to online content and communicating with other colleagues
- The user tendency to learn and socialize while learning using social networking services

The user responses to the open-ended question in the survey (the last question) reflected their interest in education through SC services. The answers included some words or ideas related to facilitating access to content, enhancing the content itself, developing new integration between education websites and social networks, enhancing the security of content and user privacy, and developing the technical side of these websites to be more effective in learning and education. These concerns reflect a user concern with developing social websites to serve more toward learning and socialization.

Findings from the data analysis of the second data part

The following eight passages include comparisons between the data collected from the survey results from one side and the hypothesized factors by UTAUT from the other. This comparison will lead to proving user acceptance of using SC in HE to gain more benefits in learning or teaching activities.

Reputation: the UTAUT model hypothesizes a strong link between user acceptance of any new technology and gaining a more positive reputation in his or her community. The survey results of the reputation-related questions show that there is a strong link (optimism levels of 74%, 83%, 84%, 86%, 88%, and 89% across the samples as shown in Table 1.5). Therefore, the survey results on using SC in HE prove same hypothesis as UTAUT. The above data are consistent across all samples, confirming the strong link of reputation with performance expectancy and with behavioral intention. In addition, the numbers show that this factor has the strongest link among all hypothesized relationships. Hence, a new link path could be constructed as shown in Figure 1-3.

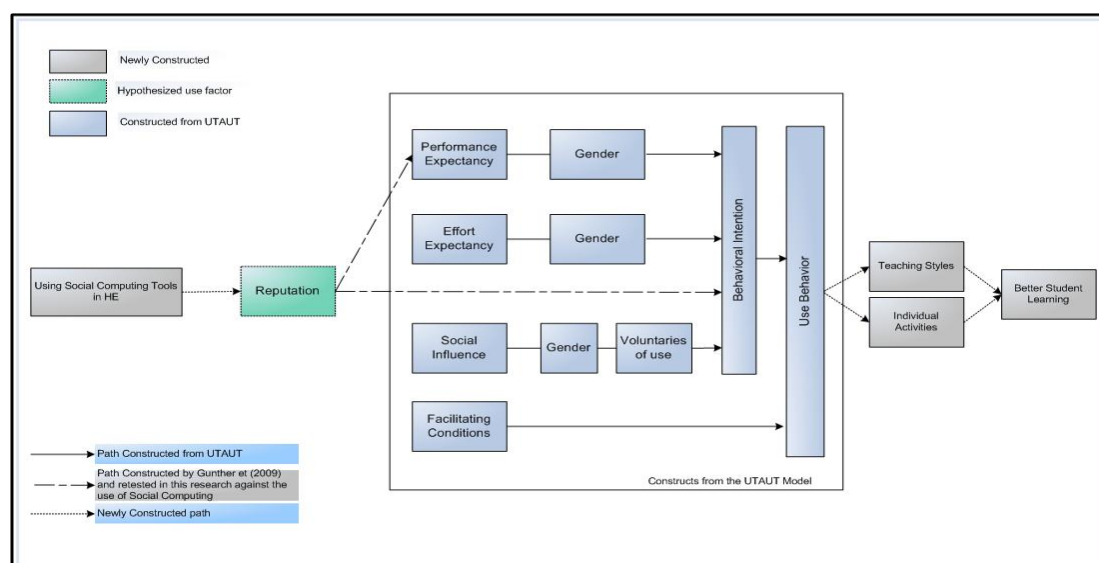


Figure 1-3: Reputation factor

Expected Relationships: The results from question 5 about the expected relationships are not as strong as reputation but still confirm strong relationships across all samples. An average mode of 4 (optimism levels of 82%, 83%, and 84% as shown in Table 1.5) across all samples in question 4 shows the mind-set of all participants toward their behavior to deliberately use SC to create relationships and receive benefits. Hence, another link path can be constructed between using SC in academic institutions and the “Expected Relationships” construct, which is positively related to behavioral intentions and performance expectancy. Figure 1-4 shows the new constructed path.

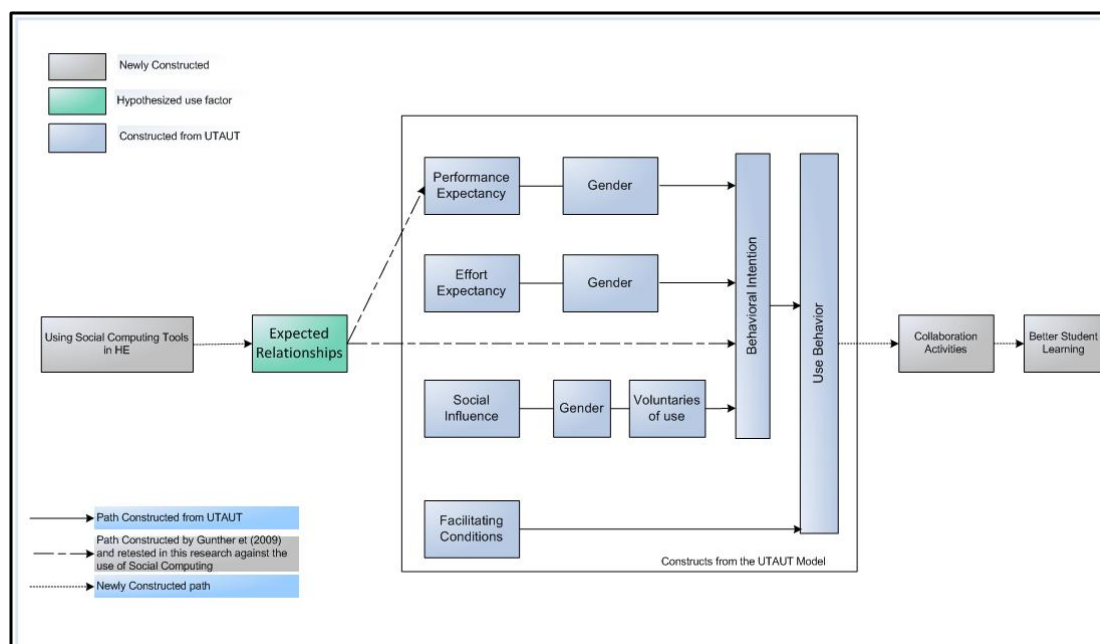


Figure 1-4: Expected Relationships factor

Communication Benefits: The results from the questions about the expected communication benefits confirm a strong relationship across all samples between communication benefits and performance expectancy. The collected answers on questions 5 and 6 have an average mode of 4 across all samples (optimism levels of 74%, 76%, 79%, and 88% as shown in Table 1.5), which reflect user intention to use SC to communicate and get benefits from communication. A new path can be constructed between implementing SC in HE and the “Communication Benefits” factor, and between “Communication Benefits” and “Performance Expectancy” (positive relation) in the UTAUT model. Figure 1-5 illustrates this path.

The collected answers showed consistency between the surveyed samples when asked about the social influence of the gained communication benefits. The majority of them agreed on the positive relation between communication benefits and social influence. Figure 1-5 illustrates that path as well.

Signal-to-Noise Ratio: The important revelations from questions 7 and 8 had to reconsider the hypothesis about signal-to-noise ratio. The practical thought process from the reviewed experiences and literature seemed flawed from the results that have been received by surveys and data collected from interviews. Across all samples, participants believed that the signal-to-noise ratio will easily be greater than 1:1 when

SC is used in HE. The average responses ranged from neutral to disagreement from the participants on using SC if the noise will be higher than the educational signal (optimism levels of 49%, 53%, 68%, 74%, 88%, 90%, 92%, and 94% as shown in Table 1.5). This result confirms the need to develop SC networks and services dedicated for education. This will help the user benefit from using SC in HE with a lower ratio of noise.

The collected results also show a positive relation between “Signal-to-Noise Ratio” and “Effort Expectancy.” Hence, a new link path can be constructed between the SC updates and the signal-to-noise ratio, which is inversely linked to performance expectancy and positively linked to the effort expectancy.

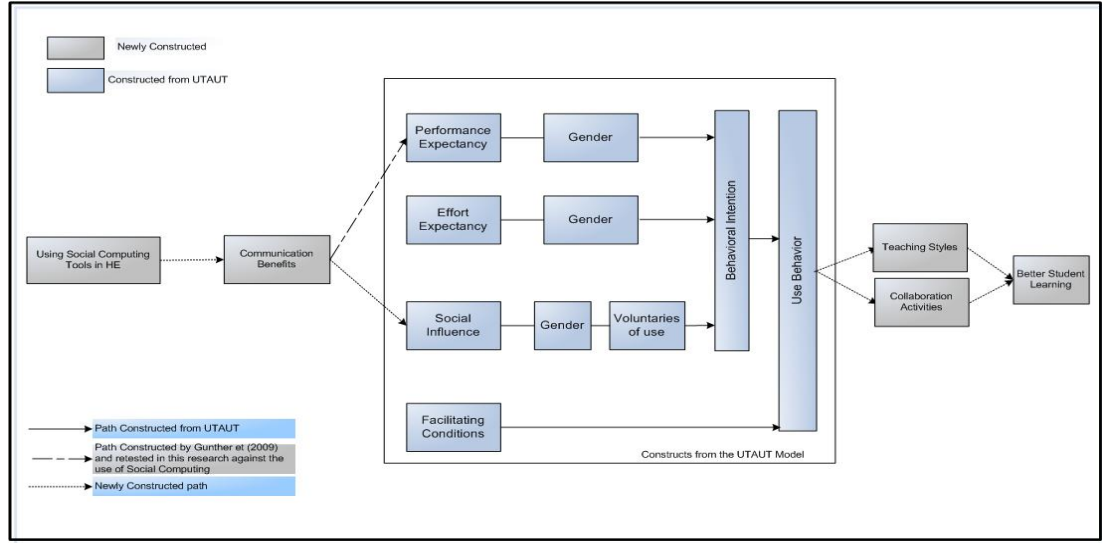


Figure 1-5: Communication benefits factor

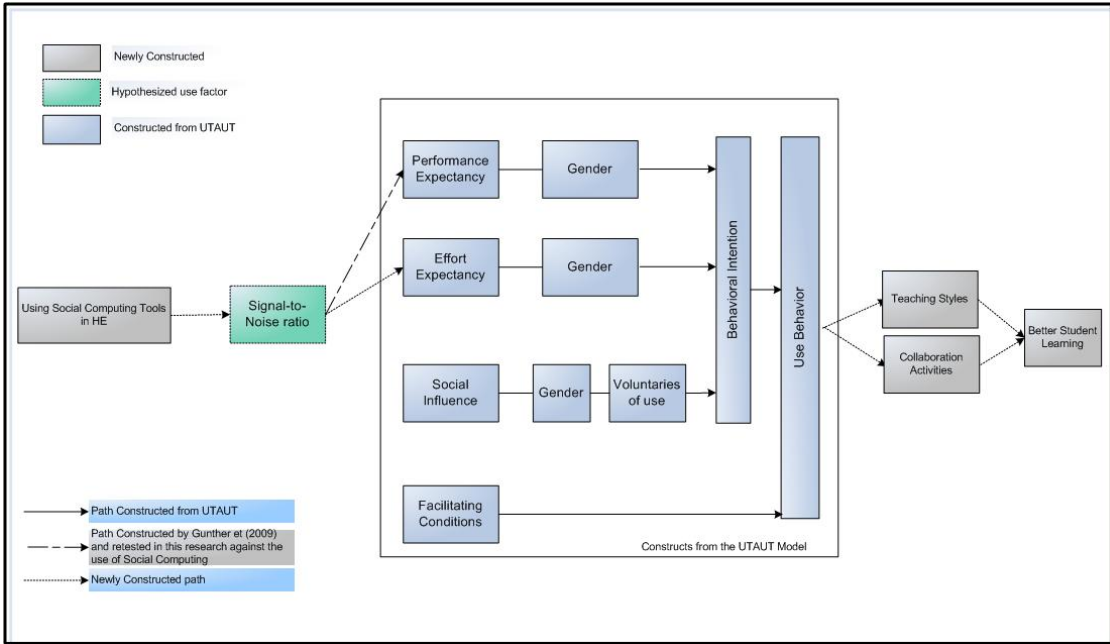


Figure 1-6: ‘Signal-to-Noise Ratio’ factor

Codification Effort: The responses to the codification effort questions show very strong agreement from most of the participants, which confirms the weak links with performance expectancy and behavioral intention, as hypothesized by the UTAUT model. Both questions for codification effort (questions 9 and 10) received modes of 5 (with optimism levels of 63%, 72%, 74%, 76%, 82%, 84%, and 88% as shown in Table 1.5). A new link path can be constructed between using SC in HE and the codification effort, which is inversely related to performance expectancy. In addition to the collected results, the logical sense confirms a positive relation between “Codification Effort” and “Effort Expectancy.” These paths are shown in Figure 1-7.

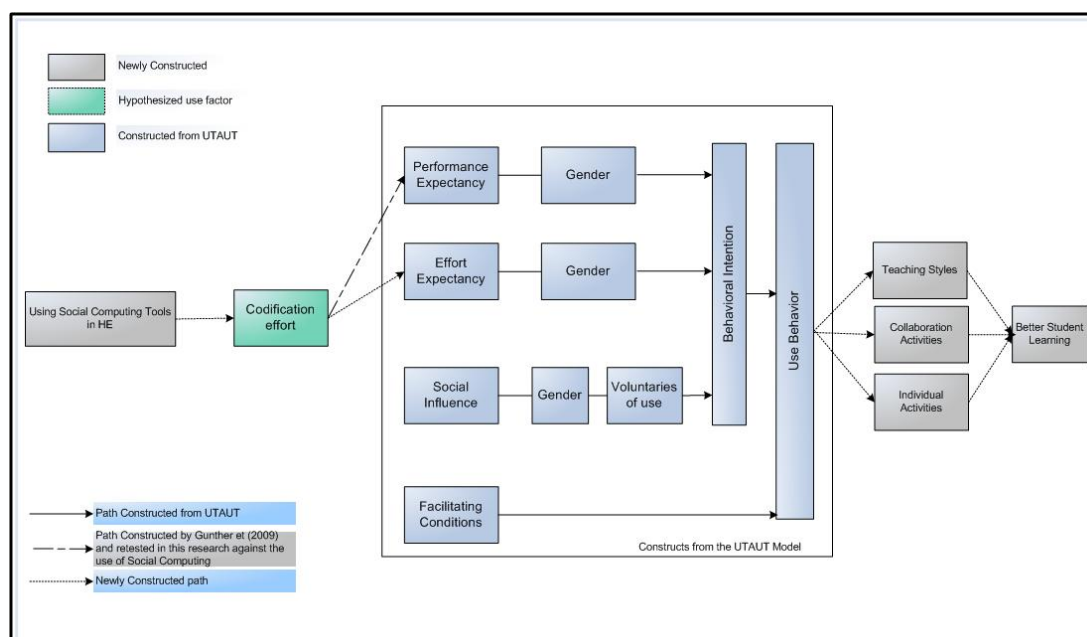


Figure 1-7: Codification effort factor

Privacy Concerns: The answers to the privacy concerns questions consistently show very strong agreement from most participants, which confirms weak links with performance expectancy and behavioral intentions, as hypothesized by the UTAUT model. In the context of privacy concerns (questions 11 to 13), most participants were neutral about the idea that the cost of security is more than the benefits one receives from deploying SC in HE (optimism levels of 52%, 60%, 63%, 65%, 68%, 75%, 84%, 87%, 88%, 92%, and 94% as shown in Table 1.5). This could be due to a lack of actual implementation being done in academia. Another path can be developed based on Gunther’s finding between using SC and privacy concerns, which is linked to behavioral intention as shown in Figure 1-8.

Collaborative Norms: For the collaborative norms factor, questions 14 and 15 received positive support from all samples. This is approval for the strong link with behavioral intentions. The participants showed strong agreement with the hypothesis (optimism levels of 71%, 76%, 79%, 80%, 82%, 83%, 90%, and 92% as shown in Table 1.5), which results in a strong link between collaborative norms and behavioral intention. The hypothesis is that using SC is linked to privacy concerns, which is linked to behavior intention with inverse relationships. The users agreed that collaborative norms lead to social influence, which indicates a positive relation between both constructs. These relation links are illustrated in Figure 1-9.

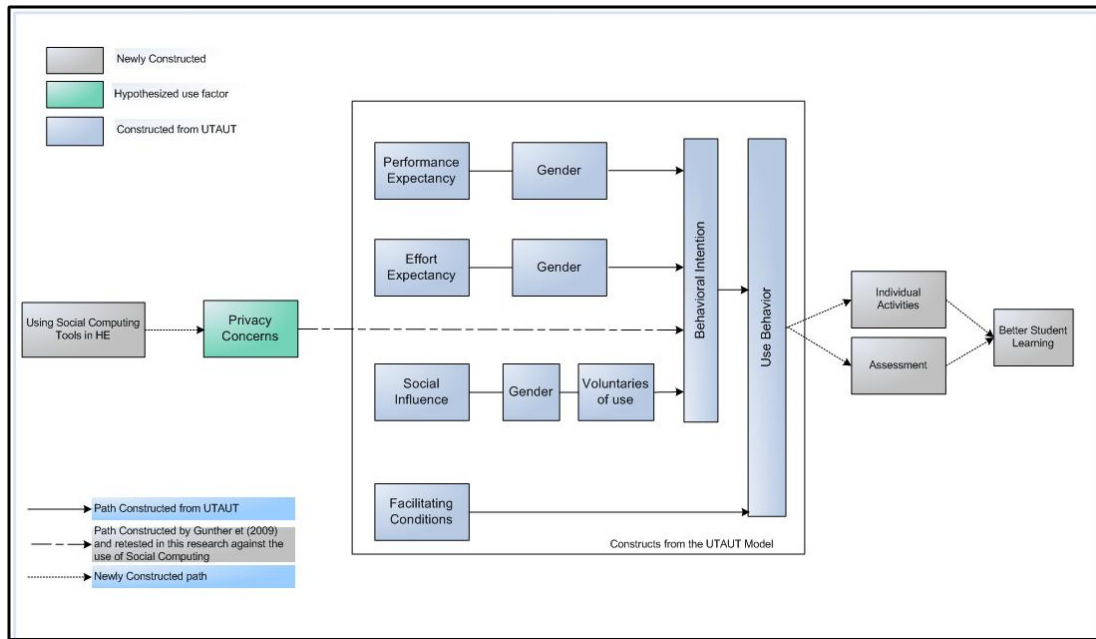


Figure 1-8: Privacy Concerns factor

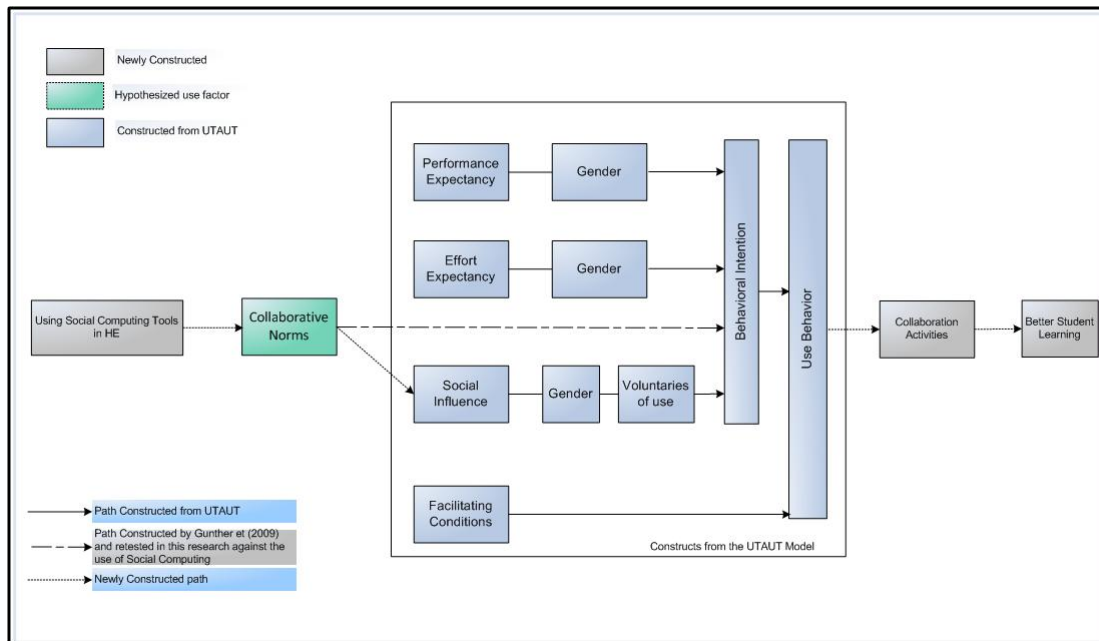


Figure 1-9: Collaborative Norms factor

Facilitating Conditions: The last hypothesis is that strong facilitating conditions with regard to the infrastructure of the academic institution are required with a flexible budget for SC to flourish. The participants agreed that a flexible budget is necessary in implementing SC in HE. With an average mode of 4, questions 17 and 18 went strongly against this hypothesis (optimism levels of 42%, 49%, 52%, 64%, 72%, 74%, 77%, 78%, and 92% as shown in Table 1.5). Based on the survey results, the participants felt that SC applications would be used extensively regardless of the IT

infrastructure of the organization. The interview discussions included a clear tendency from the users to consider SC as a totally web-based technology; consequently, the users would be able to use it regardless of the university's or organization's technology infrastructure. Although this is not absolutely true—since infrastructure capabilities, including the communication lines and security devices, might affect the level of use—this shows the readiness of the participants to use SC technologies with minimum capabilities. Although the results were against the hypothesized link by UTAUT, they confirm the tendency of different stakeholders to use SC in HE. Hence, using SC can be directly linked to the “Facilitating Conditions” construct. Figure 1-10 illustrates this relation integrated with the UTAUT extension link (Gunther et al. (2009)) between facilitating conditions and use behavior and the proposed link between facilitating conditions and behavioral intention. An additional link was developed between facilitating conditions and effort expectancy based on the collected results.

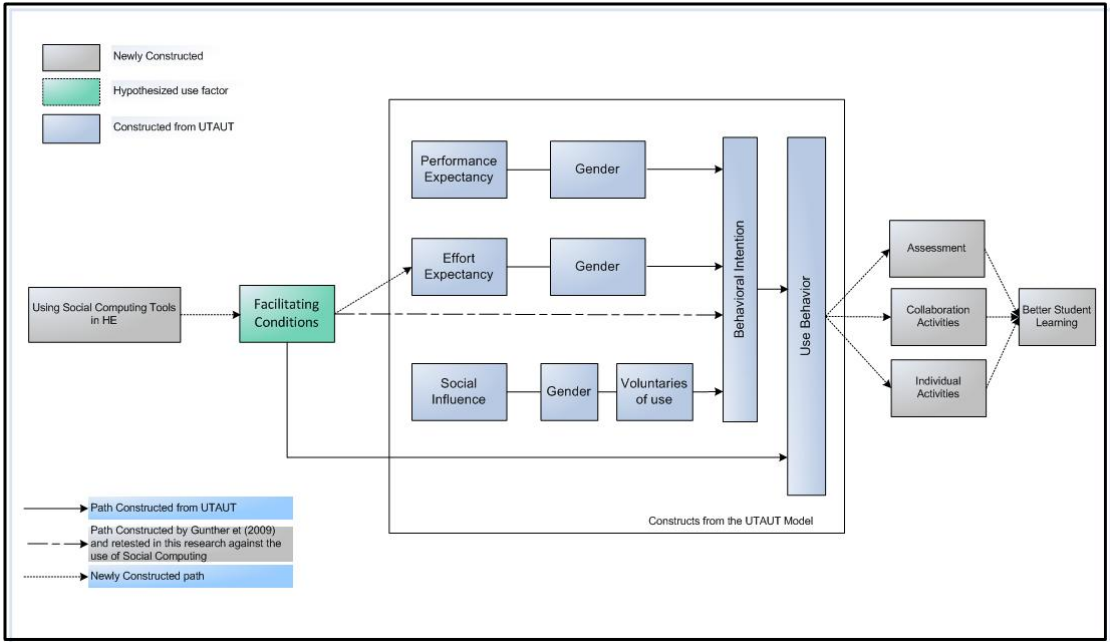


Figure 1-10: Facilitating Conditions factor

1.1. Framework Formulation (Putting it all together)

Table 1.6 summarizes the comparison between the results from analysis in this research and the links hypothesized by UTAUT and Gunther's (2009) expansion based on the results from the proposed surveys. By integrating each of the studied factors with performance expectancy, behavioral intention, and use behavior, a new model can be formulated to predict the reasons that should be considered when adopting SC tools in HE. Putting all these factors together with the UTAUT constructs linked with the hypothesized links in this research and the hypothesized links by Gunther (2009), the following conceptual model can be presented to show the factors that affect the use of SC in HE in the Gulf states. This model was developed based on the conducted studies in the case-study institutions. These institutions include samples of the present stakeholders of HE in the Gulf states. Figure 1-11 illustrates the framework constructs and how they are related to the original UTAUT

constructs. It also shows how SC is linked to these constructs in a way that proves user acceptance of using its tools and consequently promoting learning levels.

Table 1.6: Factors survey analysis-part2

Factors		Chosen Dependency	Hypothesized Link by the UTAUT model	Result from Analysis	Compare with UTAUT Hypothesis
3	Reputation	performance expectancy	strong link	strong link	same as hypothesis
4		behavioral intentions	strong link	strong link	same as hypothesis
5	Expected Relationships	performance expectancy	strong link	strong link	same as hypothesis
		behavioral intentions	strong link	strong link	same as hypothesis
6	Communication Benefits	performance expectancy	strong link	strong link	same as hypothesis
7	Signal to Noise Ratio	performance expectancy	<i>weak link</i>	<i>strong link</i>	<i>against hypothesis</i>
8					
9	Codification Effort	performance expectancy	weak link	weak link	same as hypothesis
10					
11	Privacy Concerns	behavioral intentions	weak link	weak link	same as hypothesis
12					
13					
14	Collaborative Norms	behavioral intentions	strong link	strong link	same as hypothesis
15					
16	Facilitating Conditions	behavioral intentions	strong link	strong link	same as hypothesis
17		behavioral intentions	<i>strong link</i>	<i>weak link</i>	<i>against hypothesis</i>
18					

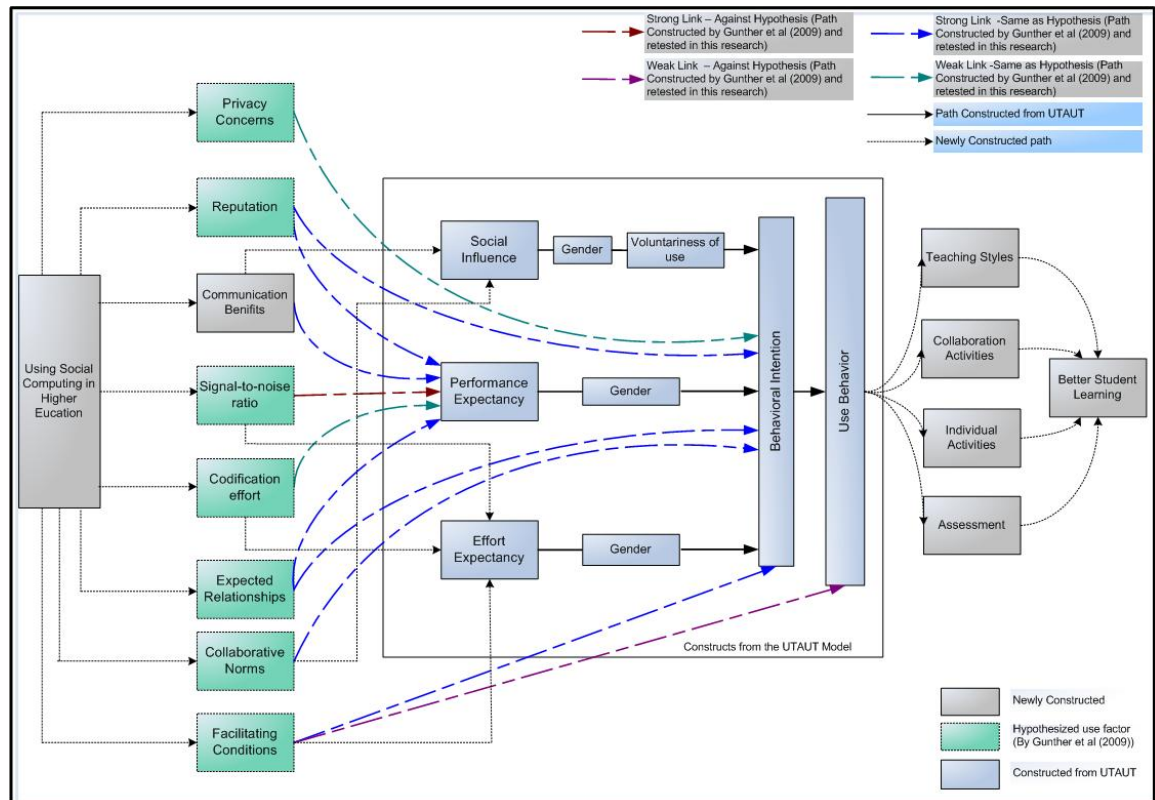


Figure 1-11: Conceptual Framework for implementing SC in HE in the Gulf States.

Significance And Usage Of The Framework

This framework contributes to the body of knowledge by presenting a theoretical base for implementing SC in HE in the Gulf states. It also extends the research on technology acceptance by extending the UTAUT theory to include extra constructs related to the use of SC in HE. With regard to developing successful external validity and generalizing the research findings to the whole HE domain, the developed framework will also work also as an additional version of UTAUT specified for the use of the specified SC technologies. Future research might be conducted on extending the research findings to use SC in other businesses, which will extend the contribution to knowledge to another level. More future work will be also suggested for testing the proposed framework on other businesses (not just HE) to generalize the framework to any business in order to generate additional value.

The framework can be used as a theoretical base for developing new virtual learning environments (VLEs) that can support education with useful and effective technology tools. This might affect the future of the VLEs since the demand for social technologies in business is increasing, and SC is emerging every day in a variety of business organizations.

Framework Validation

To validate the framework, a new system prototype will be developed to simulate new VLEs that focus on using a mix of SC tools to facilitate course delivery and learning activities. Group of usability experts are invited to do a heuristic evaluation of the developed system prototype. Then a group of the surveyed users will be contacted

again to conduct usability testing and use the system to ensure it satisfies their needs and meets their expectations. The validation of the framework comes from validating the system prototype—in other words, the success of the system itself. On the other hand, when successfully validating the prototype, this validation will lead to validating the conceptual framework itself. Figure 1.12 shows the whole validation procedure.

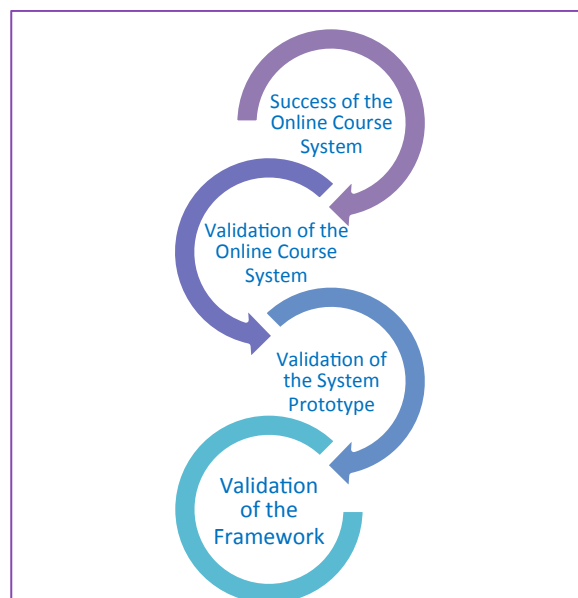


Fig 1.12: The validation procedure

The system prototype has been developed and validated using the validation procedure as illustrated in Figure 1.13.

Conclusion

Implementing SC in HE in the Gulf states was studied to detect the drivers behind using it in HE to support teaching and learning processes. Sets of hypotheses were generated based on the existing theories of technology acceptance, and then data collection was conducted to confirm the proposed hypotheses. User acceptance of SC was studied through 8 factors that might affect the intention to use SC and use behavior: privacy concerns, reputation, communication benefits, signal-to-noise ratio, codification effort, expected relationships, collaborative norms, and facilitating conditions. The research methods included surveys and interviews. Based on the findings of these research methods, the use of SC in HE in the Gulf states is linked to all these factors, which means that it affects its relation with the behavior intention and consequently the use behavior. Inverse relationships between privacy concerns, signal-to-noise ratio, and codification effort on one side and behavioral intention on the other were concluded either through direct or indirect relationships. The rest of the factors had positive relationships with the behavioral intention. A new theoretical framework has been developed to collect all these relations together and prove the existence of a great opportunity to leverage teaching and learning processes in HE in the Gulf States through enhancing the level of student learning and engagement by implementing SC. The framework works as a theoretical base for the future research and development of VLE systems. To validate the prototype and instantiate the

framework, a new system prototype has been developed and tested with a group of the survey participants.

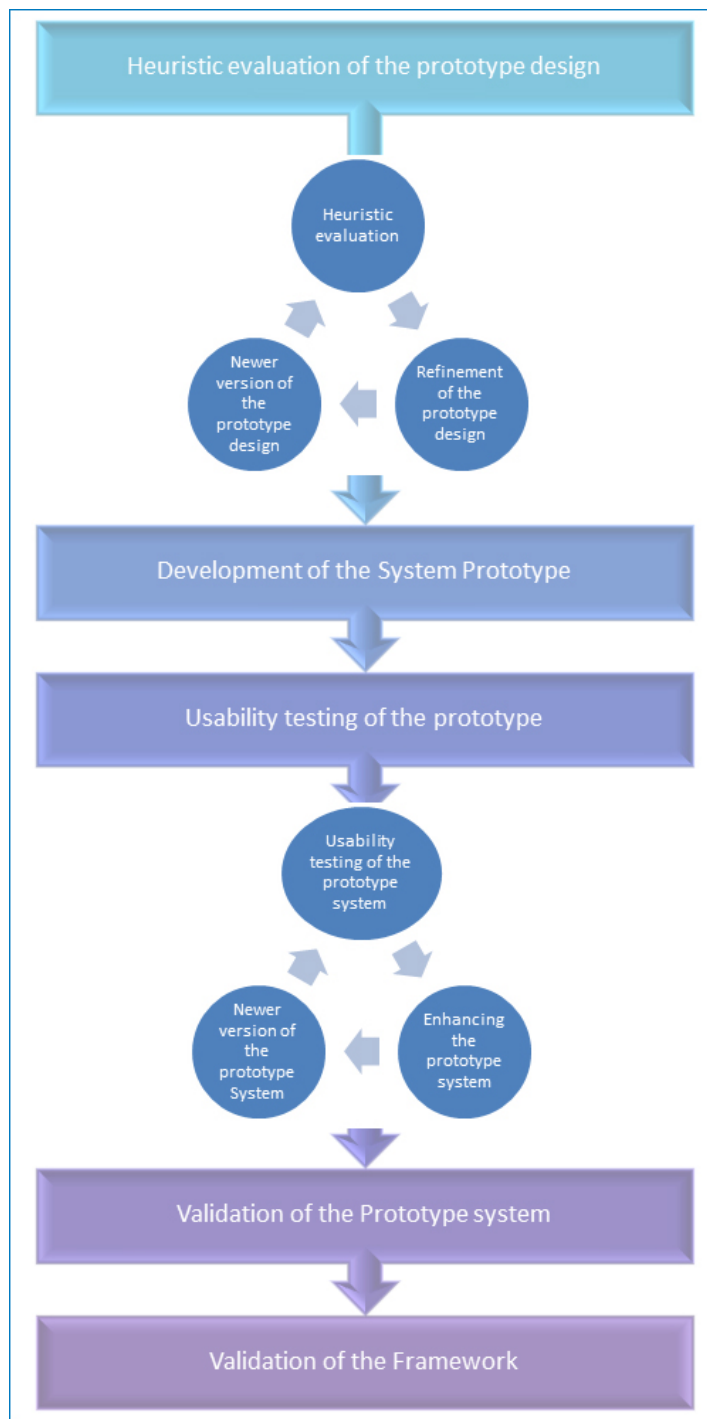


Figure 1.13: the prototype validation process

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Integrating ideas, symbols, and physical objects in architecture engineering and construction

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Abstract

This paper addresses relations between concepts, symbols, and physical objects in context of construction IT. Methodologically, discussion is based on philosophical, psychological, linguistic, and information technology. The reason the discussion is necessary and relevant lies in the indirect relationship between the symbolic and the real world. This work presents different perspectives on the relation between human conscious activity and the “real world” in order to facilitate the transformation of abstract data to physical reality. Our comprehension is that the link between concept, symbol, and physical object, in context of construction IT, is based on the reference triangle presented in *The Meaning of Meaning*, by C.K. Ogden and I.A. Richards in 1920. Discussion is thematically split into three thematic subsections. First, the concept of construction IT is presented and modern methods of planning preparation, especially visualization in architecture engineering and construction (AEC), are pointed out. In the second subsection, preliminary findings are linked with branches of philosophy and cognitive psychology dealing existence of reality, human attitudes towards reality, and human perception of reality. In the final subsection a link between modern visualization techniques and philosophical study is established. The aim of this study is to identify potential benefits that come with comprehensive use of modern visualization technologies in AEC.

Keywords

Computer integrated construction, Modern visualization techniques, Reference triangle

Introduction

The relation between reality and our perception of it poses questions empirically very difficult and, one might even say, impossible to answer. However, there are many theories that attempt to explain this relationship (Fig. 1). This paper addresses this problem from a philosophical, psychological, linguistics, and IT point of view in context of construction informatics. Bermúdez believes that there are two additional scientific disciplines dealing with this issue (neurology and anthropology). These two disciplines exceed the scope of this paper, so they will be omitted.

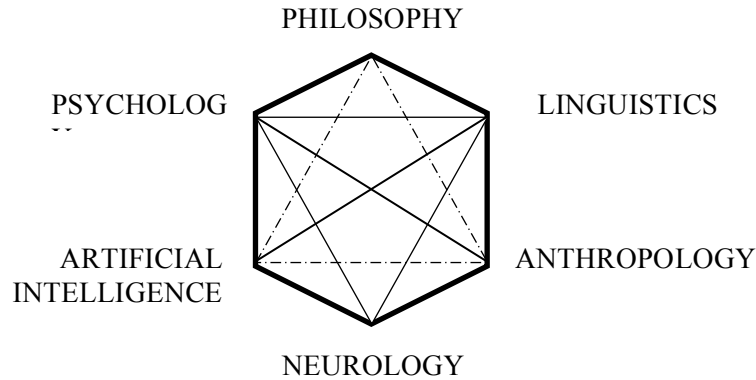


Fig. 1. Interdisciplinary (Bermúdez, 2010)

Informatics and construction informatics

Very generally, informatics can be defined as a systematic, scientific theory about information. This extremely broad field deals with both information technology (IT) and computer science by collecting, organizing, storing, transferring, and presenting data to a final user in a meaningful way. Informatics also includes the study of cognitive performance, IT system development in science, engineering, culture, education, and business environment (Tolliver, 2012). Informatics is also science that studies the relations between humans, information technology and the use of information technology use in practice (PTSI, 2012).

Construction informatics is an applied science that deals with everything written above in context of construction technology. In the past terms that were used to describe, interdisciplinary field which is related with both IT and construction, included (computing in construction, computer integrated construction information technology in construction etc.). In last few years authors most often refer to this field as Information technology in construction (construction IT). Construction informatics deals with the topics listed below:

- Adaptation of new technologies
- Introduction of new technologies into practice
- Training people to work with new technologies
- Management of information technology
- Impact of technology on business
- Economic aspects
- Cultural and psychological aspects

From everything written above, construction IT can be defined as: *"Construction informatics is applied sciences, examining the specific problems of construction-related processing, presentation and communication"* (Turk, 2006).

Due to specific characteristics of the construction industry, integration of computer technologies with everyday practice is relatively slow. Since the final products (e.g., buildings, bridges, and urban infrastructure) are usually unique, project

documentation is especially complex and often neglected. But even if we assume that our documentation is well prepared, the question of its interpretation still remains.

Modern methods of planning preparation and visualization

Building information modeling (BIM) is one of the most important areas in the current implementation of construction information (Gu, 2010). The exchange of information in the construction process is becoming increasingly challenging as tools for modeling, analysis, visualization, and simulation are becoming increasingly complex. A key issue in this area has been how to achieve interoperability between models created with different tools used throughout the product's life cycle (Cerovšek, 2010). Despite the fact that the AEC industry is spending billions for research on interoperability, this area is relatively poorly treated. The following describes the preparation methods of project documentation in the AEC.

2D CAD is used only as a substitute drawing board. Drawing enables engineers overlapping geometric views and manually (or semi-manually using "design by future" tools), thus making views linked to those of the participating experts. Manual preparation plans is time consuming and error prone, so it is not best suited for use in practice (Haymaker, 2004). Unfortunately, this method is still in daily practice.

3D BIM is a methodology through which objects get their meaning. So lines are not lines. The BIM model consists of objects such as doors, walls, and windows. Such models contain information not only about the geometry of the building, but also on the properties of components.

4D BIM, the fourth component, usually indicates time. The BIM gets a planned sequence of component installation.

5D BIM, the fifth component, usually indicates the price the individual component's BIM model.

The BIM thus includes information on the geometry and properties of the embedded components, the time sequence of construction, and the estimated cost of the final product. Such a model can also be used for the purposes of maintenance because it includes information on all installed components.

Philosophical view

In modern philosophy, there is no single opinion on the relationship between real objects, symbols that we use to describe them, and the concepts to which they refer. Beginning in the twentieth century especially, philosophers began to deal with the issues related to the existence of reality and its attitude towards our mental awareness. The following branches of philosophy deal with the existence of reality, our attitude towards reality, thinking, and communication:

Metaphysics attempts to explain logically those events in the universe that cannot be seen or measured (Rozman, 2002). Metaphysics is a branch of philosophy that attempts to draw general speculation on the world and, with that, completely explain reality and all experiences (Palmer, 2002).

Ontology is the branch of philosophy that deals with questions of existence, such as, "What is there? What is the difference between appearance and reality? What is the relationship between mind and body? Do numbers and concepts really exist, or there are only physical objects?" (Palmer 2002) Ontology is an explicit specialization of

concepts. With artificial intelligence (AI), the question of "what exists" refers to what is being represented. Thus, for AI ontology is defined as a set of names of entities to operate programs and understand people (Gruber, 1992).

Phenomenology is the study of the development of human consciousness and its self-awareness. This philosophical movement describes the formal structure of objects (Webster, 2012).

Hermeneutics is a field of study initially associated with how to interpret the teachings of holy texts. In contemporary philosophy hermeneutics has become a general theory of understanding. One of the founders of modern hermeneutics was Martin Heidegger with his work *Being and Time* (German: *Sein und Zeit*).

Cognitive psychology

The main task of cognitive psychology is to understand the nature of human intelligence and its performance (Anderson, 1995). Cognitive psychology also deals with links between the senses, nervous system, and brain.

Although our environment is made up of light waves and sound, we do not see it that way. We do not see light waves, see the poster. We do not hear the sound waves, we hear the music. The perception of a phenomenon is only the first step. Something more is needed to give meaning to things. Only when a thing gets its meaning can it act. It can be argued that the role of perception is putting meaning to the received information.

Linguistics

Linguistics is the scientific discipline primarily engaged in the study of language. It can be divided into several levels to give varying perspectives on the communication process. Semantics is the study of the meaning itself. Semantics can be defined as a means to prepare the meaning of words, which are leather on deled within linguistics. Pragmatics is the study of how the primary meaning relates to the current context and the listener's expectations. Syntax is the study of grammar, which sets rules to form sentences.

A field of linguistics is also related to AI. Developers of AI need a theory about how communication between man and machine takes place and commonly use conceptual graphs (preliminary conceptual graphs) in this endeavor (Sowa, 1984).

Reference triangle

The triangular representation of concepts can be traced back to Aristotle, who introduced a distinction between things, words, and experiences in the psyche (Sowa 1984).¹⁰ Fig. 2 presents a similar scheme of relations presented by Ogden and Richards (1923) near the beginning of twentieth century. Communication relations between the angles of the "reference triangle" can be presented by the following procedure:

1. Referent brings a thought person/writer
2. Person/writer relates a thought with a symbol
3. Symbol brings a thought of person/reader
4. Person/reader relates symbol with an object

¹⁰ *Psyche* refers to whole of human thought, both conscious and unconscious.

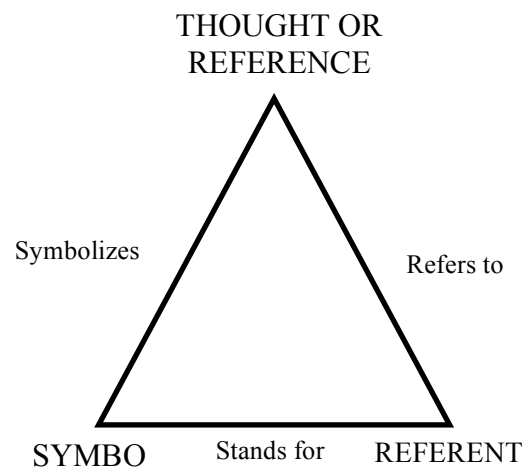


Fig. 2. The reference triangle

Relations between object–concept and concept–symbol can be illustrated with an example. In one of the corners we have the object. The concept can be illustrated with the thought in the mind that refers to that specific referent (object). The symbol is a visual or audible signal symbolizing the idea about that referent. The presented sample shows that it is possible to establish a direct relation on the sides referent–reference and reference–symbol.

The relation between the symbol and the object is slightly more complicated because a direct connection cannot be established. This is why this connection is so much more interesting.

If construction is illustrated as a flow of information from the symbolic to the real world, and, as it can be seen, there is no direct connection between those two, the actual process of construction occurs in the human mind (human interpretation).

Object

An object is something material, something that can be detected by the senses, and something that triggers a reaction when it is detected. An object can also be imagined as something material or mental to which a stream of thought can lead.

You can also imagine the concept of building a mental or physical object that is perceptible or of which can be channeled stream of thoughts. In construction, an object usually denotes a physical object built to meet specific needs or perform a certain activity. Such objects can be built, restored, and maintained.

Symbol

In its broadest sense, a symbol can be defined as an object, picture, written word, or set of code that represents an idea with a deeper meaning; it is some kind of a content holder. Symbols can be used to present real or abstract objects and concepts. A deeper philosophical view of the symbol gives the idea that the symbol is not really a means to transfer information about the real world. A symbol is the only means by which we get response to our initial message. In context of construction, an IT symbol can be referred to as a *model*.

Thought of reference

As the branches of philosophy that deal with the relationship between the conscious mind and the physical world, hermeneutics and phenomenology have already been defined. Their development was strongly marked by Heidegger. The essence of his philosophy is that humans act mainly in a pre-reflective manner. They only take action when confronted with a given situation in everyday life, that is when a breakdown happens (Fig 3).

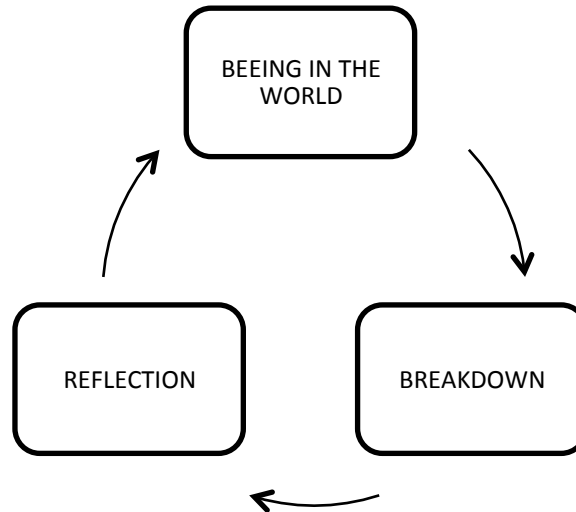


Fig. 3. The reflection loop (Turk, 2011)

Modeling in relation with construction

According to Heidegger, people act primarily in a pre-reflective manner. They are not aware of their existence, so they function on the rule of intuition. The world that surrounds them is not made of objects. One only begins to understand that the real world is made of objects after a breakdown, the decomposition that happens when there is a problem. Only when breakdown happens do people start to create objects in their consciousness. These objects can be illustrated with symbols. This process may be related to modeling in construction informatics. The main purpose of modeling is to create models that adequately reflect the actual state of entities, or the things that they represent. For this, it is necessary to use appropriate and precise quantitative formalisms. If possible, one must compare the models with facts in nature. With that, it is possible to adjust the models so that they accurately reflect nature's form (Foley, 1984).

The inverse of modeling is the transformation of information from the model into a physical reality (fig 4.). This is quite simply the construction process. One would like a direct connection between the symbol and the object, but this option *does not exist*. Mechanisms of control of construction are still taking place in the human conscience.

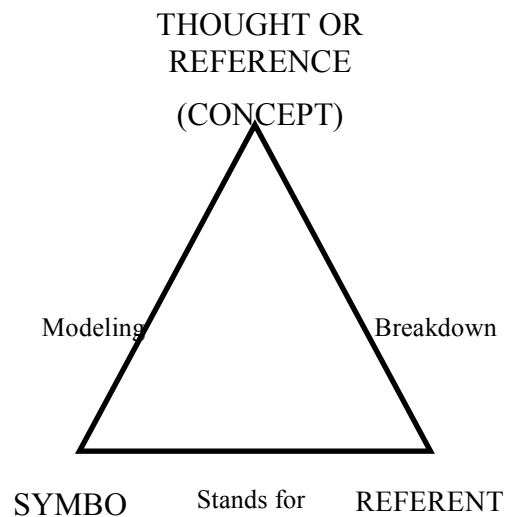


Fig. 4. Process of construction

Summary

In this paper we presented the relationship between symbol, concept and object viewed through the prism of philosophical, psychological, linguistic, and computer theory. Philosophers see the world that surrounds extremely abstract. With the exception of the phenomenological theory of applicative value, the field of construction information is very limited. Psychologists and linguists have very similar theories about how we perceive reality. In simple terms, it comes down to three steps: perception, processing, and comprehension. Psychologists do not deal as much with the relationship between the symbolic and the real world; they believe it is the same thing. Linguists deal more with the processes of the human mind and with communication problems, which primarily take place in the human mind.

Computer science, and, correlated to that, construction IT, is a kind of whole that combines all previously presented views on the world that surrounds us. It deals with the transfer of information from the real world in the abstract. The second, even more important, process is that of construction, which is a mirror opposite of the process of modeling, it is a flow of information from the models in the physical reality.

If we want to reduce the number of errors due to incorrect modeling and construction, we must seek the possibilities of bridging the gap between the real and the symbolic worlds, since, as it follows from our discussion, there is current no direct link perceived between them.

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Exploring E-Business Technology to Support Improvement in the Infrastructure Procurement Process in the Ghanaian Construction Industry

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Abstract

There is growing interest globally in the conduct of construction business transactions by utilising electronic means through the Internet and or dedicated network of computers and other ICT elements. This is often referred to as e-Business technology. The infrastructure project procurement process in the Ghanaian construction industry is predominantly a paper-based transaction. This approach has several procedural limitations, notably concerning communication difficulties between project partners (consultants, architects, construction managers, quantity surveyors, engineers, suppliers, contractors and subcontractors including statutory authorities); this in most cases has led to transactional delays, inadequate communication processes, and lack of transparency in the procurement process. These issues therefore need to be addressed in order to maintain an efficient and effective infrastructure procurement system in the Ghanaian construction industry. Advances in Information and Communication Technologies (ICT) have had a significant impact on organisation's business processes, using them as key drivers in sharing project information and other relevant business engagements. This paper is a literature synthesis based on an on-going PhD research which aims to propose a framework for e-Business Technology Transfer to the Ghanaian Construction Industry utilising International Joint Venture projects as a medium.

Keywords

ICT, e-business Technology, Infrastructure, Procurement System, Construction Industry

Introduction

A review of literature identifies that the advent of the Internet technology as a business system platform has been a catalyst for major changes in the operations and status of organisation procurement including construction (Croom and Brandon-Jones, 2007). There is growing interest globally in the conduct of construction business transactions by utilising electronic means through the Internet as it is an information intensive industry (Brewer and Gajendran, 2009). Information in the form of communications between contractors, designers, clients and other key participants often predominates within construction and project success depends on the effectiveness and efficiency of these communications. Work by researchers such as (Howard *et al.*, 1998, Hassan and McCaffer, 2002, Acar *et al.*, 2005, Ingirige and Sexton, 2007) shows the growing development in this area.

More and more companies mostly in the developed economies are conscious of the needs to introduce Internet-based technologies such as e-Business in their operations, due to the benefits of: saving transaction costs; increasing competitive sourcing opportunities; and enhancing inter-organisational coordination (Ho *et al.*, 2008). The situation is not the same in developing countries as there is evidence to suggest that the uptake of ICT elements within construction is quite low. For instance, Ofori (1994a) and Ofori (1994b) studies countries such as Tanzania, Ghana, Kenya and Peru shows how backward the status of ICT uptake is. In countries particularly in the West Coast of Africa the situation seems extremely poor (Oladapo, 2006). However, Isikdag *et al.* (2011) recently noted that the utilisation of e-business elements such as e-Procurement within construction in the developing countries is beginning to present opportunities for improving the traditional procurement processes by improving communication and coordination along with expanding the marketplace for both suppliers and buyers.

Ghana in recent times witnessed some attempts by researchers bringing to light the benefits of this under developed source of competitiveness in both retail and the financial sectors e.g. (Hinson, 2011, Hinson, 2010, Hinson and Sorensen, 2006). Increased participation in the construction industry in recent time has been observed as a result of the improvement of the economy, notably in the influx of foreign construction firms to the country utilising International Joint Ventures (IJVs) and different forms of alliances. Although these activities have been observed within the construction industry, there has not been any detailed assessment of how these foreign firms help the national economy and also improve the skills and capacity of the indigenous construction firms within the Ghanaian construction industry.

The initial review of literature relating to construction in developed and developing countries indicates that key improvements in infrastructure delivery and better performance could be achieved through ICT elements within the construction industry. ICT can be used to achieve many functions and performance can be improved in many ways. In the context of Ghana where foreign firms and schemes where foreign and local collaboration is sought, ICT has the potential to spearhead improvement in the industry. One of such key ICT elements that has not been fully investigated in the developing countries context in general and Ghana in particular is e-Business Technology (eBT). Therefore, this research attempts to develop this undervalued and currently under developed source of competitiveness within the construction industry in Ghana in a way sympathetic to the needs of a developing country.

Literature Review

Overview of the Ghanaian Construction Industry

The construction industry in Ghana grew by 20.0% in 2011; second after Mining and Quarrying which recorded the highest growth of 206.5% (GSS, 2012). The construction industry remains one of the major routes for generating or creating new wealth and value to meet other economic and social goals in Ghana. However, the industry is fraught with problems such as low productivity, lengthy pre-contract award procedures, corruption, and delays resulting in time and cost overruns and unsatisfactory quality of work (Ahiaga-Dagbui *et al.*, 2011). The construction industry in Ghana is characterised by a multiplicity of small firms (Ayarkwa *et al.*,

2010). Eyiah and Cook (2003) noted that the large construction firms consist mainly of foreign firms whilst the small firms are mostly Ghanaian indigenous businesses. According to van Egmond and Erkelens (2007) out of a total of 7095 construction firms registered in Ghana in 2002, ninety per cent were small contractors who belong to classes D3 and D4 and undertake less complex construction jobs with tender sums up to one million US dollars. Ayarkwa (2010) claims that the total amount of work executed by these small contractors ranges between 10% and 20% of the total construction output. However, these small construction firms could also be accounting for over 50% (cost-wise) of all building materials production and nearly 80% of all short-term employment (including casual labour), especially for unskilled workers in many deprived communities in Ghana (Amoah *et al.*, 2011). Resource management is an important key in the successful implementation of any project however, Ayarkwa *et al.* (2010) note that the management of resources such as labour, finance, materials plant and equipment is carried out haphazardly in Ghana and therefore does not promote good performance and enhanced growth.

The following section highlights procurement in relation to infrastructure development and some inherent challenges and the way forward.

Infrastructure Procurement in Ghana

Procurement processes and procedures in Ghana have gone through a number of changes, with the main objective of reducing or at best eliminating corruption in the procurement of physical infrastructure, realising value for money, efficiency in the procurement process, and streamlining the procurement process as well as establishing sanity in the physical infrastructure procurement environment among others (PPA, 2010). These socio-economic realities have intensified the search for more innovative means of delivering public services, such as physical infrastructure, and the need to achieve better services (Anvuur *et al.*, 2006). This culminated in the passing of the Public Procurement Act, Act 663, in 2003 (PPA, 2003).

Although Act 663 provides equal opportunity and a level field for industry players and procurement practitioners, the entire procurement process is manually based and this has led to practitioners calling for the establishment of ICT elements such as e-business in order to eliminate issues concerning corruption, delays and communication difficulties and to focus on organisational efficiency and value-adding processes in the infrastructure procurement process (PPA, 2010). The potential of ICT elements for improving the quality of procurement services in the construction industry is generally acknowledged (Oladapo, 2006).

The next section discusses the contribution of construction to national economies and identifies the importance of ICT and ICT research works within the construction industries world-wide.

ICT in Construction

Construction is unquestionably one of the most significant industry contributors to the economy of many countries in terms of GDP and employment (Hampson and Brandon, 2004). The industry plays a vital role in producing the needed economic infrastructure; therefore, the industry holds strong indicators as how any given economy is moving. The construction industry is one of the biggest in the world. The contribution of this industry towards global GDP is approximately 10%. The industry

is also a potential employment generator and provides work to almost 7% of the total of employed people in the world (Economy Watch, 2010). In a survey report published by PriceWaterHouseCoopers (PwC), it was suggested that global construction would grow by 70% from \$7.2 trillion today to \$12 trillion by 2020 (PwC, 2011).

For example, in UK, construction represents 7% of GDP or £110 billion per annum of expenditure, some 40% of this being in the public sector, with central Government being the industry's biggest customer (Cabinet Office, 2011, UKCG, 2009). Scaling the discussion down to the contribution of SMEs within the construction industry in the UK, Griffith (2011) further established that Small and Medium Enterprises (SMEs), especially the repair and maintenance subsector employment activities accounts for approximately 49%, or £51 billion, of annual construction output and employing over half of the entire industry's workforce. These statistics shows the significance of the construction industry and its contribution to the national economy. However, the construction industry has been perceived as underperforming in terms of meeting its own needs and those of its clients (Ofori *et al.*, 2011). Hence, several industry review exercises were undertaken in the UK in particular. One such review that is relevant to this research was the Latham (1994) Report. Latham (1994) clearly identified the lack of meaningful integration within the construction industry with particular reference to project partners as a major impediment affecting the performance of the UK construction industry. The report recommended strongly the use of ICT systems to facilitate communications within the industry as a means of securing improve performance. This culminated in numerous strategic national and international initiatives to address the application of ICT within the construction industry, such as the Department of Trade and Industry (DTI, 2001) which recommended several changes to the future of construction including the use ICT. ROADCON (Hannus *et al.*, 2003) project offered a vision for ICT in construction in addition to a set of roadmaps across 12 thematic areas. Although the construction industry knows the importance of ICT systems, its uptake within the industry has been low whilst the potential of e-Business technology to increase productivity and efficiency has not been exploited (Vitkauskaite and Gatautis, 2008).

The above discussion shows that construction can perform better when ICT systems are exploited fully. However, from a developing countries perspective, Ghana in particular, ICT systems such as e-Business technology has been under developed, therefore, this research attempts to develop this technology in the construction industry in Ghana.

Sections 2.4 – 2.5 discusses relevant e-business definitions and e-Business technology transfer via International Joint Ventures (IJVs) to Developing Countries and e-business trends.

Definition of e-Business

In recent years, the use of the Internet technology for business has been on the increase mostly across manufacturing, retail, banking and other business sectors. The benefits of using Internet technology to conduct business have been well noted and researched, the emergence of Internet technologies has far-reaching ramifications on the way business is conducted (Gunasekaran and Ngai, 2008). This act of conducting

business can be referred to as electronic business (e-Business) and in some research documentation it is also referred to as electronic commerce (e-Commerce). To gain an understanding of e-Business or e-Commerce, this research attempts to identify definitions of this terminology and then relate it to the construction business process.

There are ranges of definitions for e-business and e-commerce. From the work of Damanpour and Damanpour (2001), that e-Business and e-Commerce is any “net” business activity that transforms internal and external relationships to create value and exploit market opportunities driven by new rules of the connected economy. Similarly e-Commerce is referred to as business transactions by electronic means through the Internet and/or dedicated networks (Anumba and Ruikar, 2002). According to Damanpour and Damanpour (2001), The Gartner Advisory Group, a research and advisory services firm, describes e-Business in terms of a quantity rather than an absolute state of a company. They consider a business an e-Business to the degree that it targets the market opportunities of conducting business under new electronic channels, which revolve around the Internet. This is an acknowledgement that e-Business comes in many forms and can be implemented to a very small or large degree. It is also an acknowledgement that the “Internet” and the “Web” are essential components of an e-Business and e-Commerce strategy. Fundamentally, e-Business can be defined as the interchange of goods, services, property, ideas or communications through an electronic medium for purposes of facilitating or conducting business (Costello and Tuchen, 1998) cited in Cheng *et al.* (2001).

Laudon and Laudon (2000) cited in Ruikar and Anumba (2008) defines e-Business as the use of the Internet and other digital technology for organisational communication, coordination and the management of the firm, it encompasses these different adaptations. In the broadest possible terms, however, e-business is an electronic way of doing business (Anumba and Ruikar, 2008). Therefore, companies must participate in external business relationships by using computer interactions (i.e. transactions, support, marketing, communication and collaboration) by either business-to-business or business-to-consumer, if it is to be considered an e-business (Damanpour and Damanpour, 2001). Cheng *et al.* (2001) argue that e-business infrastructure is used to improve communication and coordination, and encourage the mutual sharing of inter-organisational resources and competencies. This was further corroborated in a general perspective by Muffatto and Payaro (2004) arguing that e-business is the process whereby Internet technology is used to simplify certain company processes, improve productivity, and increase efficiency. It allows companies to easily communicate with their suppliers, buyers, and customers, to integrate “back-office” systems with those used for transactions, to accurately transmit information, and to carry out data analysis in order to increase their competitiveness. To support the inter-organisational sharing of resources and competencies in a network structure, communication and co-ordination need to be maintained (Cheng *et al.*, 2001).

From the above definitions Kalakota and Whinston (1996) are of the view that the original meaning of e-Business is attached to the establishment of a computer network to search and retrieve information in support of business decision making and inter-organisational co-operation.

The above definitions clearly explain the importance and usefulness of e-Business technology in all economic sectors including construction. However, this technology is under developed in developing countries particularly in the Ghanaian construction industry. Therefore this research attempt to utilise International Joint Ventures (IJV) projects within the construction industry in Ghana as the medium of transferring e-Business technology to the Ghanaian construction industry. The next section discusses e-Business technology transfer utilising IJV projects.

e-Business Technology Transfer via IJVs to Developing Countries

Kogut (1988), argues that joint venture (JV) is used for the transfer of organisationally embedded knowledge which cannot be easily blueprinted or packaged through licensing or market transactions. JVs are considered an important alternative to acquisitions, contracting, and internal development. According to Ozorhon *et al.* (2007) international joint venture is a joint venture involving two organizations contributing their equity and resources and at least one partner having headquarters outside the country where the joint venture operates. A significant degree of risk is involved in joint venture investments (Shen *et al.*, 2001). These notwithstanding, JVs have been successful in many industrial sectors. There is a general desire within many industries to sustain the growth of JVs. For example in construction, IJVs have turned out to be an essential sector within the global construction industry. It provides an effective basis for achieving a win-win situation and implementing synergistic teamwork whereby the majority of the large scale construction projects in many developing countries have been delivered by using IJVs established between international and local construction firms. In the context of this research, IJVs are considered as a mechanism to transfer organisational knowledge (Kogut, 1988, Lyons, 1991, Ozorhon *et al.*, 2007). This according to Maskus (2004) refers to any process by which one party gains access to a second party's information and successfully learns and absorbs it into the production function.

Form a Sub-Saharan Africa perspective particularly in the Ghanaian construction industry context, Ahiaga-Dagbui *et al.* (2011) studies potential risk to International JVs in developing economies with particular reference to the Ghanaian construction industry. The study identified two major risks factors. They explained the risks as follows: the major risk factors including the microeconomic and financial risk factors and joint venture partner problems. The client's ability to finance the projects and poor technical, financial and managerial capacities of Ghanaian construction firms were the main factors in this group. The minor risks factors include the availability and high cost of construction materials, issues of bribery and corruption, power supply problems and security. However, Ahiaga-Dagbui *et al.* (2011) note that using IJVs as vehicles for such competition and technology transfer have been beneficial to developing countries construction industries.

Sections 2.6 – 2.8 discusses trends of e-business, barriers and significance to the Ghanaian construction industry.

e-Business in the Ghanaian Construction

The uptake of e-Business in the Ghanaian construction industry has been relatively limited and ineffective as compared to other engineering sectors such as the automotive or the aerospace industry (Ruikar and Anumba, 2008). One or two major reasons have been alluded to by many authors and researchers; the fragmented nature

of the construction industry and the one-off nature of its products (Cheng *et al.*, 2001, Ruikar and Anumba, 2008). The complex nature of construction project activity has been well documented by researchers and construction industry players. Predominantly, construction project activity involves several key participants, for example, contractor, subcontractors, architect, engineers, and quantity surveyors (Egbu *et al.*, 2008). The construction project environment requires team work, involving inter-organisational collaboration and dialogue. According to Ruikar and Anumba (2008) traditional communication and document exchange models were often manual and hence slow. Issa *et al.* (2003) conducted a survey to assess the USA construction industry's attitudes and perceptions with respect to e-Business focusing on determining the level of adoption of e-Business within project management systems by general contractors. The following common trends of e-Business in construction (see figure 1) have been identified: Product Promotion, e-Procurement, Project Management, Project Collaboration and Online Tendering (Alshawhi and Ingirige, 2003, Issa *et al.*, 2003, Ruikar and Anumba, 2008).

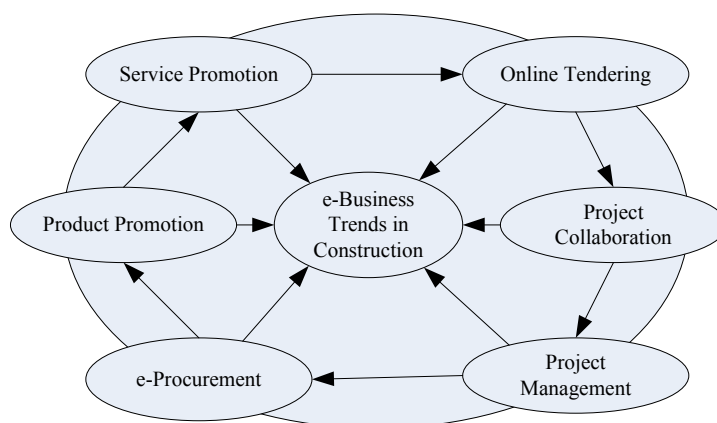


Figure 18 - e-Business Trends in Construction

Adapted from the discussions in Ruikar and Anumba (2008) and Issa *et al.* (2003)

Barriers to e-Business Initiatives in the Ghanaian Construction Industry

It is a commonplace to determine perceived barriers ahead of any findings to establish the exact barriers to the implementation of e-Business in the construction industry in Ghana. From Eadie *et al.* (2010a) and Eadie *et al.* (2007) enablers established in construction are considerably relevant for any modern day construction industry. On the contrary, the small nature of firms operating in developing countries construction industries, the identified barriers to a large extent may defer slightly even though some level of agreement is possible. From a developing country perspective Isikdag *et al.* (2011) carried out a web-based questionnaire survey to determine the key barriers to e-Procurement in the Turkish AEC Industry related to the technology, organisational strategy, market, human factors and processes. The findings of the survey include issues such as: technological infrastructure and related security; lack of ICT skills among staff; difficulties in re-engineering of business process for supporting the information flow in the e-Procurement process. These findings are similar to the result of the empirical analyses done on small-medium sized firms by (Love *et al.*, 2001). Vitkauskaite and Gatautis (2008) argue that the major barriers for

increased uptake of ICT among SMEs are very much related to: a lack of resources; insufficient knowledge about ICT cost and benefits; absence of skills; as well as the prevailing traditions and culture in this sector. The situation in the Ghanaian construction industry may not be anything different from the works of Love *et al.* (2001) and Isikdag *et al.* (2011) as identified above. For example, (Owusu-Tawiah, 1999) cited in Ayarkwa *et al.* (2010) noted that the majority of Ghanaian contractors operating within the construction industry do not have sufficient funds and credit facilities and also lack appropriate technological capabilities, plant and equipment as well as key personnel to handle construction projects properly.

From the works of Eadie *et al.* (2007); Eadie *et al.* (2010a) and Eadie *et al.* (2010b) which was conducted in Northern Ireland and the UK amongst other things identifies infrastructure culture and other issues to consider critically as these issues have the tendency to derail implementation of e-Business within construction. As noted earlier Love *et al.* (2001) discovered among other things technical, financial, organisational and behavioural barriers to e-Commerce implementation in construction. However, in a more general view Ruikar and Anumba (2008) point out that general barriers to e-Business mainly fall into three categories, namely infrastructure, trust and reliability, and regulatory issues. Additionally, Issa *et al.* (2008); Ruikar *et al.* (2008); Wilkinson (2008) and Ismail and Kamat (2008) conducted scholarly studies on different aspects of e-Business in construction mainly from a developed countries perspective. From the available literature, the construction industries in developing countries have been completely left out in most of the referenced studies, nonetheless, it provides a theoretical framework and platform for the commencement of research into the application of e-Business technology within construction from a developing countries perspective particularly Ghana. Most studies on e-Business technology application in construction have been conducted on developed economies. However, in recent times there have been attempts to undertake similar studies within the Ghanaian economy. Hinson and Sorensen (2006) conducted a study into the application of e-Business within the non-traditional export sector principally arguing that the adoption of e-Business practices has benefit for small Ghanaian exporters' organisational improvement.

Arguably, this study by Hinson and Sorensen (2006) can be confirmed as the first in the context of e-Business within the economy of Ghana. Sørensen and Buatsi (2002) assessed the use of the Internet within the export business in Ghana. Further, Hinson *et al.* (2007) focused on the Internet use patterns amongst internationalising Ghanaian non-traditional exporters. Although, there is an acknowledgement that some amount of work have been done on e-Business technology transfer to the construction industries in developing countries and some different sector(s) within the economy of Ghana, the body of knowledge did not appear to have supported the fundamental necessities of e-Business technology transfer within industries in developing countries particularly the Ghanaian construction industry. This research in part therefore, attempts to address these fundamental barriers in furtherance to adding value to existing body of knowledge in the area of e-Business technology in the construction industry in Ghana.

Significance of e-Business Technology to the Ghanaian Construction Industry

As noted previously, e-Business has precipitated the move from traditional internally focused logistics and Supply Chain Management (SCM) models to new systems built

on network-based, ICT-facilitated collaboration. This entails the sharing of critical and timely data and relevant information on the movement of goods as they flow from raw material all the way through to the end user. The net effect is end-to-end supply chain optimisation based on open communication between networks of project partners. According to Moodley (2003), e-Business could provide the building blocks for an integrated ICT system, including: (1) a network of project partners; (2) a single point of connection to all participants in the value chain and production network; (3) a common digital platform to facilitate seamless communication and transaction processes among project partners; and (4) real-time response capabilities to adapt to unplanned events in the value chain. Additionally, the construction industry in Ghana stands to gain capacity improvement in the general construction process by taking advantage of the trends identified in section 2.6

Research Methodology

This paper is primarily based on a literature review of the research topic as the basis for formulating a comprehensive method to undertake research into e-Business technology transfer within the Ghanaian joint venture construction projects. Literature has been drawn extensively from different sources, particularly in the areas of construction where the current status of the Ghanaian construction industry has been reviewed together with ICT application in other jurisdictions especially in the developed economies and e-business application in the construction business. The materials for this literature review for this paper have been largely drawn from journals, conference proceedings, industry reports, relevant books and websites.

Future work of this Research

Research into ICT elements such e-Business in construction especially within construction in developing countries provides enormous challenges therefore, extensive research on e-Business technology and application in construction will be undertaken as this research progresses. This is intended to address research potential and requirements in the area of e-business technology in the Ghanaian construction industry. Broadly, the aim of this research is to propose a framework for e-Business technology transfer to the construction industry in Ghana utilising International Joint Venture projects as a medium. This is essentially to improve the infrastructure procurement process and in order to achieve the aim of this research, a set of objectives have been formulated some of these objectives include assessing the structure of the construction industry, procurement practices and the development of local skills; exploring the use of e-business as part of ICT and general infrastructure. Other objectives of this study would be to identify key fundamental requirements for implementing e-Business technology within the construction industry in Ghana; to develop a framework for the adoption of e-Business technology in the Ghanaian construction industry to help improve performance and transparency in the procurement process. As this research progresses, these objectives will be continually refined to meet emerging issues within the confines of this research. This research will continue by undertaking a comprehensive literature review into the research areas as stated above. This will then be followed by interviewing major industry players and some documentary analyses. The framework for the adoption of the e-Business technology will then be validated within the construction industry in Ghana by utilising a focus group approach.

Conclusion

Although there is a limited amount of literature on general e-Business technology and its application in construction in developing countries, particularly Ghana, the issues discussed in the literature above show that e-Business possesses a great potential that is likely to impact positively on almost all construction procurement processes. In spite of some difficulties alluded to in the literature especially the slow uptake of e-Business technology, there is evidence that e-Business improves collaboration and communication among construction partners and professionals and also improves performance in a project lifecycle.

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A Conceptual Model for Building Requirements Processing

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Abstract

In a brief, the functional diagram comprises information related to activities and flows at an abstract level. It serves as a basis for architects to develop their architectural concept. Brief is therefore a first requirements processing proposed by the programmer, constraining architects' solution space. The usual issue is that this processing is only described in the brief, spread in the text and difficult to track or update. This research work aims at providing a design artefact to support and formalize the requirements processing summarized in functional diagram. This article describes the concept of meta-space. Meta-space diagram covers more requirements than the functional diagram and provides several analysis viewpoints to the programmers for performing the requirements processing. This contribution is developed from observations made on architectural programming theory and practice on a real construction project. Tools/techniques from other engineering domains are used to design and consolidate the proposal. A preliminary case study illustrates its application on a built multimedia library.

Keywords

Architectural programming, brief, functional diagram, meta-space diagram, requirements processing

Introduction

In Architecture/Engineering/Construction, briefing is the stage when owners define the requirements for their building project (Ryd, 2004). The brief reports the idea and needs of a client to be communicated to the architectural design team. It is recognized as one of the most important phase of construction project (Tzortzopoulos *et al.*, 2006; Yu *et al.*, 2008). In France, the functional diagram is used to illustrate a specific part of the brief, i.e. the functional requirements focused on activities and flows at an abstract/conceptual level. Based on it, architects develop their design concept and space planning regarding the layout requirements, spatial division and typology of activities.

This functional diagram represents a first processing of the functional requirements performed by the programmer. It provides a set of constraints to the architect's solution space. The functional requirements are related to the services to provide within the future building. These services are refined into processes and activities. They are then summarized in the "space planning table". Functional spaces hold the name related to the activities they are associated to. Lines describe information related

to flows in the processes. The requirement processing done by the programmer is not formalized but can be found in the brief text that explains each functional space. Nevertheless, there is a theoretical and practical shortage to pass from structured requirements toward functional spaces and diagrams. There is a loss of information traceability between these two steps.

The research issue addressed in this work is related to linking these original functional requirements to functional diagram. The main hypothesis of the authors relies on the possibility to explicitly track the functional requirements from the brief to the functional diagram. This could be done in a neutral and readable formalism using meta-space diagrams. An additional step in the briefing process is thereafter required to deal with it. This contribution is developed from observations made on a professional training on architectural programming (i.e. theory) and in the context of a briefing process for a construction project in Luxembourg (i.e. practice). The scientific methodology relies on the analysis of tools and techniques from other engineering domains in order to design and consolidate the proposal. A first case study is provided to assess the interest of the approach.

First section of this paper introduces the functional diagram to the readers from a theoretical/educational perspective. The second section analyses its first application on a real case study in the context of a service delivery. Issues and limits are developed in this part. Third section presents the main contribution, the meta-space diagram, a design artefact for linking functional requirements to functional diagrams. In the fourth section, the meta-space diagram is applied on an illustrative case study, a multimedia library built and operational since 2008. Last section of this paper opens discussions and conclusion about the value added, potential uses and limits of the meta-space diagrams.

Functional Diagram in the Architectural Programming

This section describes the functional diagram principles. It is developed from a literature review as well as a French professional training on architectural programming. Functional diagrams could be compared to other techniques used in architecture like matrix diagram (White, 1986), bubble diagram (Fortin, 1978), schematic plan (Ruch, 1978), adjacency and affinity diagram (Alread and Leslie, 2006), zoning diagram (Wurzer, 2012) or architectonical schema (Wurzer *et al.*, 2012). Difference is that functional diagram is used for requirements illustration and processing in the context of this paper whereas the other diagrams focused on space layout issues (i.e. adjacency problem) during the design.

A functional diagram is both a design artefact and a working method used by the programmer. Its main objective is to help the contracting owner, then the architect, deal with the functional and spatial organization of the future building without enclosing themselves into architectural solutions too early in the project design. Functional diagram is a graphical synthesis (Fig. 1) of a set of requirements. They become easier to handle and to understand by the contracting owner as well as the architect than traditional textual brief. It focuses on functional requirements and functional organization of the spaces from the space planning table. The functional diagram is a first analysis/synthesis of the contracting owner's requirements by the programmer. This high level synthesis is instantiated into the architect's drawings who performs the second analysis/synthesis of these requirements.

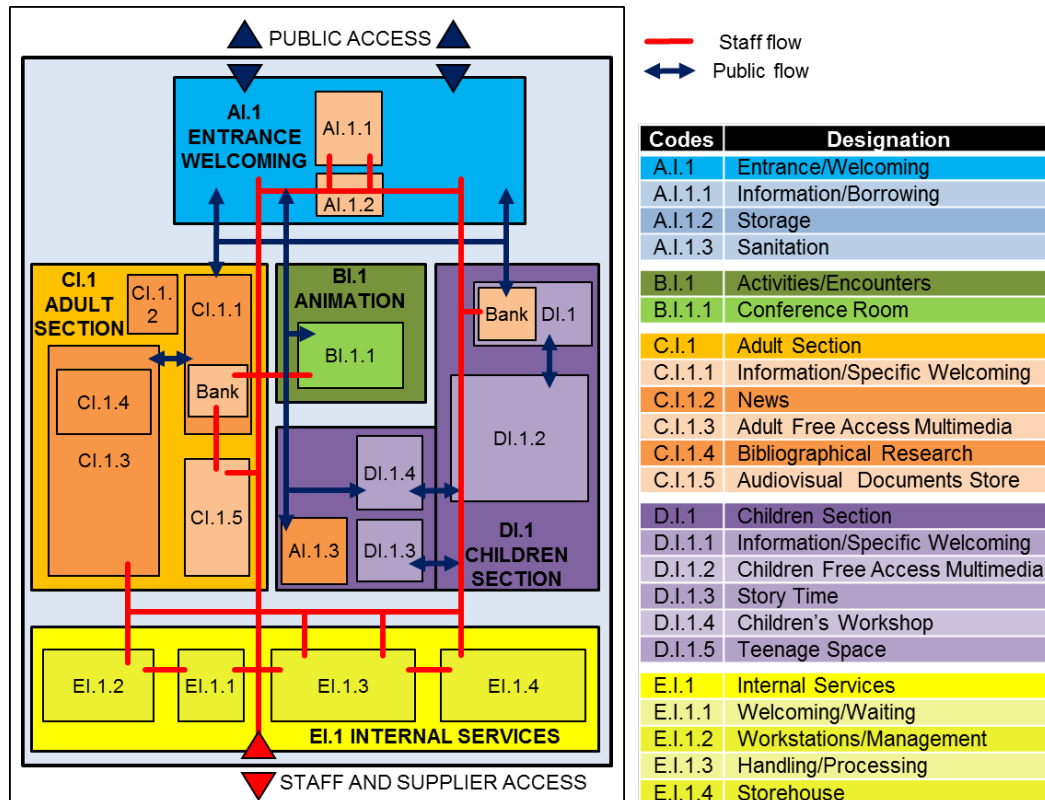


Fig. 1. Simplified functional diagram based on the multimedia library brief (Aubry & Guiguet Programming, 2003)

The information required to define the functional diagram of a building is related to the services that the contracting owner aims to provide to its users. It is part of the functional requirements that define the building. These services are developed into processes and activities linked sequentially and temporally. Based on their more or less accurate definition, the programmer is able to define and refine the kind of building (e.g. library, toy library, or multimedia library) and its spatial typology (e.g. adult section, administrative area) and to estimate the dimension of each functional space. This static information (m², designation, characteristics) is gathered in the space planning table. The functional diagram illustrates the dynamic information between spaces and their functional organization. It realizes it through a high level drawing of the physical spaces with a concrete and easy to read artefact. It is a first illustration and synthesis of the functional requirements by the programmer.

The functional diagram is composed of simple geometric figures, usually circular or rectangular forms, named according to the function they ensured (e.g. welcoming, information/borrowing) or the name of a required space for specific activities (e.g. storehouse, conference room). Spatial union, intersection, or exclusion can be expressed by figure superposition or grouping. Lines and arrows of different colours illustrate the flow of entities (e.g. staff or public flows) between the functional spaces regarding the functional organisation. They are sometimes augmented with icons or symbols to represent key characteristics (Certu, 2006) (e.g. access points, specific resources) depending on the degree of information the programmer wants to provide. Using these geometric figures, the functional diagram gives substance to the organic

structure of the building in a clear and simple way. They are usually drawn using vectorial 2D-drawing software applications.

The functional diagram does not substitute the brief; it provides a visual synthesis support to it. The quantity of information the programmer could illustrate is limited by its own readability. Moreover, the synthesis processing is not well represented. It prevents from tracing back requirements hidden behind a line or geometric form. Detailed information and explanations are given by the brief. Several functional diagrams can be drawn if necessary to give additional global or local, synthetic or detailed viewpoints. Some programmers extract parts of the functional diagrams when developing a space or an activity in the brief as a supporting illustration.

There are a lot of different kinds of functional diagrams. The geometric figures, colours, icons, and symbols vary from a programmer to another, from a project to another. There is at the time no standard formalism defining their use or describing their notation and content. By the way, neither the geometric figures nor their layout prejudice what the architectural solution will be (Vanneyre, 2011). On the one hand, it does not bridle the architect; it only defines the scope of his architectural solution space (Certu, 2010). This context provides the architect a profitable freedom to express their creativity and ensure the diversity of the proposals. On the other hand, despite the simplicity of the used geometric artefacts, it lends itself to interpretation and misunderstanding (Kalay, 2001). For the same building, there could be thousands of valid functional diagrams. This is the same with architect proposals which can be numerous and totally different although based on the same functional diagram.

In France, the functional diagram is well used in the programmer community. This is partly due to the mandatory side of the architectural programming for public construction/facility projects (JORF, 2007). It is highly recommended, almost mandatory, to provide one in a brief (Certu, 2010). It is an easy way to ensure consistency and an equal understanding of each involved stakeholder. The functional diagram is also called Venn diagram, relation graph, or functional scheme (Certu, 2010).

In Luxembourg, architectural programming is not that well developed and mostly performed by architects before the design of proposals. It is often considered as a methodological competitive advantage to propose this kind of service. Functional diagrams are unknown or not used in the brief and most often the bill acts as the brief for public constructions. When analysing bills in Luxembourg, only the architect proposal is developed with the space planning, there is no functional synthesis (Chambre des Députés, 2011) apart from the text and space planning table, mainly used for cost estimation rather than functional analysis.

Field analysis

To set up the context of the field analysis and to better understand the viewpoint of the first author, it is important to underline that his background took root in the mechanical (i.e. product and system design) and industrial engineering (i.e. process design). His degree of knowledge on building is limited to project management, structure calculation, and construction techniques.

In mechanical engineering, the design of products and systems is well supported by methods and tools. They allow keeping trace of requirements and design decisions all along the design process. In industrial engineering, processes are modelled, analysed

and optimised using a set of tools and techniques. This could explain the culture shock experienced during the field analysis, and the content of the observations.

For almost one year, the research team performed the architectural programming of a public construction project in Luxembourg. As previously explained, functional diagrams are not really used in Luxembourg for the brief, mainly only when the contracting owner asks for a French programmer. After several months of effort, the brief was delivered completed inter-alia by a functional diagram of the future building.

A lot of issues were met during its development and writing. First of all, as there was no standard reference for drawing functional requirements, the team had to decide for its own graphics to represent functional requirements of the building. The most natural choice for them was to choose rectangular forms for spaces, a set of continuous or discontinuous line to represent space grouping, and different colours to distinct the typology of activities. In order to make the contracting owner better realize the size of each space, their proportions were kept in the size of the rectangles. As a result, the functional diagram ended to look more like a layout plan than a functional diagram due to the chose graphic artefacts. There was therefore a risk that the contracting owner would have trouble to step back from the proposed functional diagram when analysing architect proposals.

Another issue concerned the update of the functional diagram. It was drawn on a simple 2D-drawing software application without automation. Changes in the requirements had to be done by hand on it. After a couple of months on its design and update, consistency began to lack between each version and regarding older still valid requirements. Traceability of changes was not kept and updates became more and more difficult to process without creating known or unknown conflicts in the functional diagram. In the end, the final layout could be explained entirely by the team but it required a lot of effort and rework. Explanations were formalized in different parts of the brief, sometimes twice or thrice but with different viewpoints.

Despite these issues, the contracting owner was satisfied by the work achieved. Even if the functional diagram was not perfect, it brought to him a clearer view of what he wanted and how to define it. The use of the coloured and sized rectangular forms facilitated his understanding of parts of his original and final requirements. The functional diagram was also used to gather more requirements and detailed some others. Thus, the contracting owner discovered that he was not so aware of all the parts that composed his school and the importance of some functional aspect in the layout of the spaces. The functional diagram helped him to project himself in the functional organization of the future building without thinking of architectural solution but only programming concepts (e.g. space grouping, communication, relationship). In the end, several functional diagrams of different levels of granularity and focus were used to clarify the different parts of the brief. They were easier to read in complement of the text in the brief.

Meta-space diagram

The field analysis provided explanations about architectural programming and the use of the functional diagram as summarized in Fig. 2. Client needs are harvested orally, with little or without structure. Their needs define a fuzzy and messy solution space at first. From these needs, the programmer organizes and cleans them to provide

requirements and specifications (i.e. constraints for the architect). He formalizes the functional requirements into a functional diagram illustrating functional spaces, their typology and relations. The brief and its functional diagram provide constraints on the solution space and limit the freedom of the architect. From them, the architect designs the building through drawings, plans or 3D views.

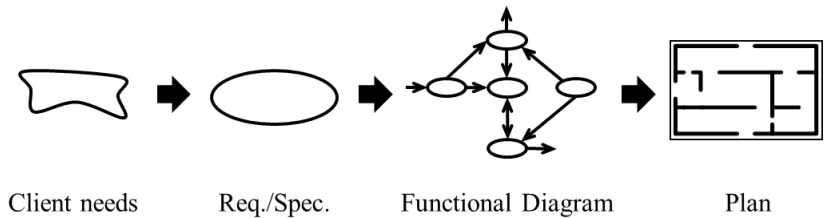


Fig. 2. From needs toward proposals, positioning of the functional diagram

Among these different representations, the authors deduced that there is certain continuity in the information from its raw version (i.e. client needs) to its graphical expression (i.e. the functional diagram). Problem is that the requirement processing required to provide the functional diagram is obscure. There was a lot of information lost or hidden (i.e. implicit) in the process. An additional step in the briefing process is thereafter proposed to deal with it through the meta-space diagram (Fig. 3).

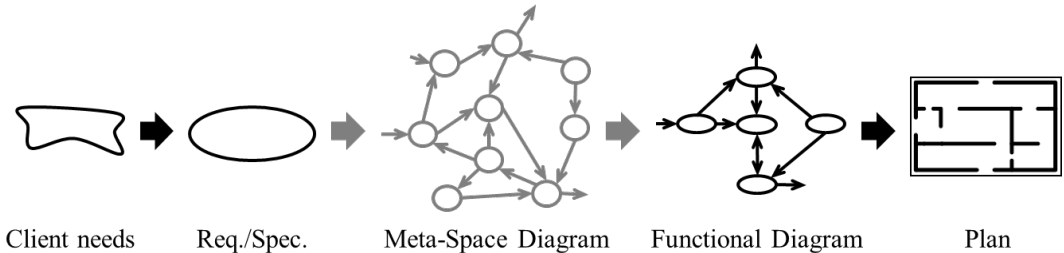


Fig. 3. Positioning of the meta-space diagram on the project development

Functional requirements in this project addressed process, activity, resources, and their relations. These concepts are modelled in different ways in other domain of engineering (see Table 13). Each one of them is explicit enough to be self-sufficient for the design team. Their uses as well as their affiliation’s domains are not limited to those provided in Table 13. The given sample of tools and techniques served as a basis to develop the contribution. Some of them are used as a preliminary step before designing a meta-space diagram (see section Application).

Table 13. Sample of tools and techniques for functional requirements modelling

Engineering Domain	Tools or Techniques
Enterprise Architecture	BPMN, Flowchart, IDEF0
Industrial Engineering	Petri Net, Graph Theory
Mechanical Engineering	SADT, GSC, BDF, Functional diagram
Software Engineering	Workflow, Use Case Diagram, State Diagram
System Engineering	Functional Flow Block Diagram

An analysis of these tools and techniques led to the design of meta-spaces. The meta-space diagram is an abstraction of the functional diagram. It is composed of meta-spaces, themselves considered as abstract or virtual spaces. Meta-spaces do not have shape or name; they only gathered information about activities they are related to. They represent the virtual “ideal” space for doing each operation. They are instantiated into functional space after being grouped on the basis of their common static (e.g. required resources, size) or dynamic (e.g. precedence, subsequence or simultaneity) requirements regarding their activities. Later on, the functional spaces are instantiated by the architect into physical spaces through his design (Fig. 4).

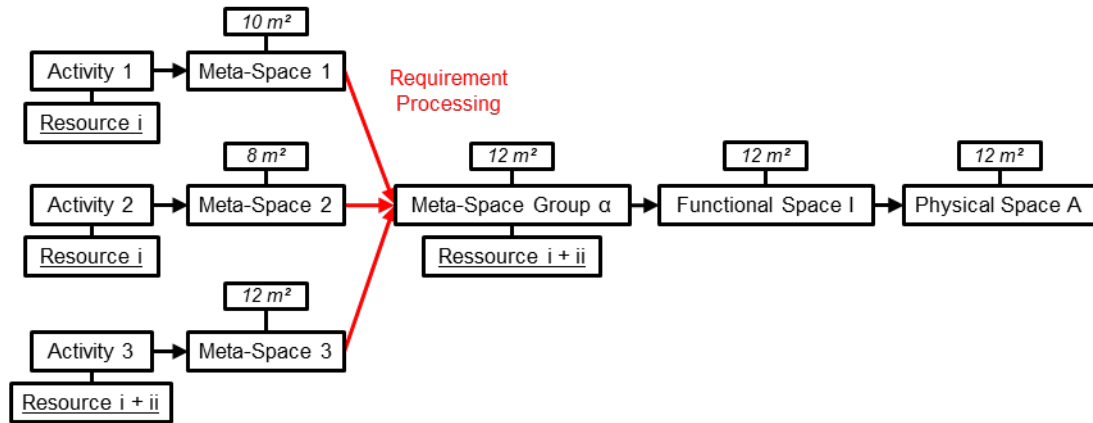


Fig. 4. Meta-Space principle

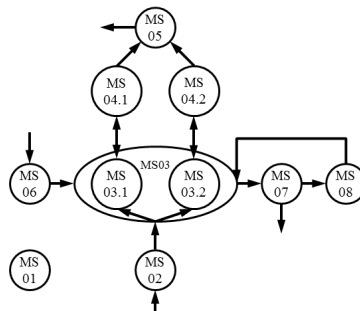


Fig. 5. Example of meta-space diagram

A meta-space diagram is an enhanced graph (Fig. 5) relative to the Graph Theory (Euler, 1736; Grason, 1971) but used in a different context (Fig. 3) and purpose (Fig. 4). Layout was not the focus of this design artefact but could benefit from it. A meta-space diagram is a set of unstructured objects connected between each other by links. Each object is a meta-space (annotated MS with a numbering) and is associated to a single operation (i.e. a non-decomposed activity) for the first iteration. Links represent precedence and subsequence of operations in a process or activity they composed. Each link is oriented in one or several ways depending on the flow of artefacts required for each activity in a process. Artefact corresponds to resources, either physical or virtual. For the first iteration, each resource is considered as a moving artefact attached to their activity. Requirements are associated to processes, activities, operations, or resources. Depending on these requirements, meta-spaces are mathematically processed to compose more or less large groups. Requirements linked

to one meta-space are processed respectively the same way as their associated meta-spaces. In the end, group of meta-spaces contained all requirements associated to its parts. Then, from the grouping, cluster of meta-spaces are instantiated into functional spaces.

Application

A preliminary application is presented in the paper in order to illustrate the application of meta-space diagrams on the functional diagram of a built multimedia library based on its brief. It constitutes a first validation that will be deepened in the following months on an on-going project as a case study.

The preliminary application was developed based on the brief of the multimedia library Théodore Monod built in 2008 in Betton, France. The illustration focused on the life-cycle of any cultural material, i.e. all the activities related to its processing, disposal, and maintenance. First input information was taken from the textual brief (Aubry & Guiguet Programmation, 2003) and the functional diagram of the building (Fig. 1). Complementary information about the life-cycle of a book was extrapolated from documents on libraries (Bleton, 1986; SDC de l'Université de Poitiers, 2011; Mercier, 2008).

The application has been performed starting from 1) an information elicitation, 2) a visual representation of them, and then 3) their processing using the meta-space diagram to 4) finally compare it with the programmer's result. The aim here was to use the meta-space diagram to reengineer a possible requirements processing done by the programmer and to record a trace of it. This application is considered as a first validation of requirements processing rationales using the meta-space artefact.

State Diagram

Based on the gathered information, a state diagram was defined to represent a simplified life-cycle of a cultural document (Fig. 6). Any kind of document the library wants to propose should follow this process, from its accession to its elimination. After accession, a cultural document has to be receipt, prepared by the librarian (e.g. covered, protected from stealing, indexed) and put away in the right shelf to be available for the public. Then, it can be temporary borrowed for on-site consultation or home consultation. After its return, it can be damaged and therefore it requires to be repaired before being available again. At the end, some cultural documents become obsolete and should be replaced by updates or new material. Each one of these activity brings a set of requirements related to their proper conduct independent from the process. The process augments them with requirements related to their layout or proximity dependencies. For example, two sequential activities should be as close as possible to reduce the distance covered by the librarian or the cultural document or the time required to perform both activities. Boundaries and measures can be added to the requirements.

Meta-space diagram

From the state diagram, the meta-space diagram was created simply by associating a meta-space to each non-decomposed activity or process (Fig. 7). Then, the physical flow followed by the document was represented between the meta-spaces using

oriented arrows. The first process was not linked to the others as the accession of a document is made on Internet via a computer-based system.

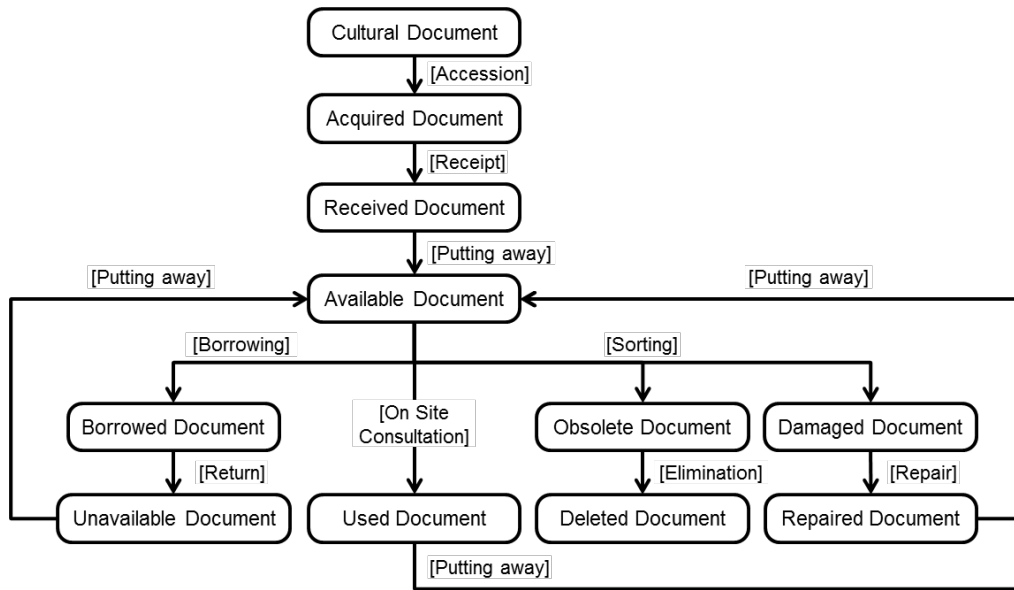


Fig. 6. State diagram of cultural document life-cycle

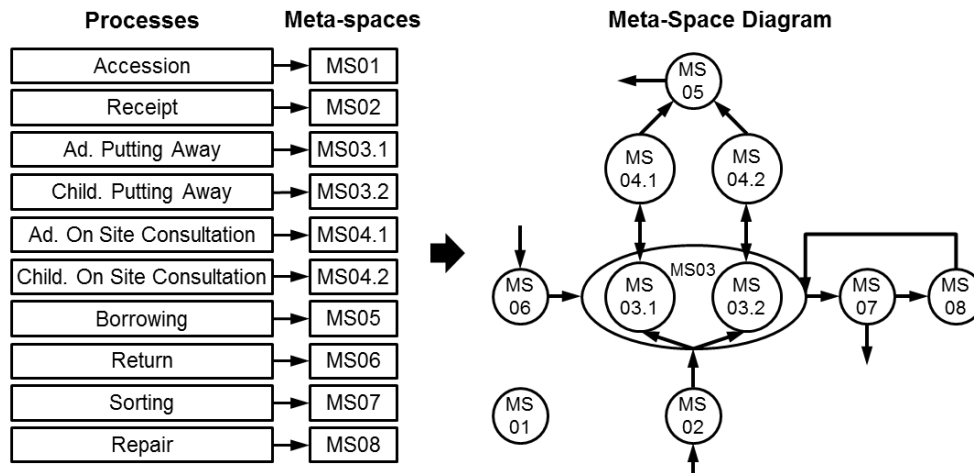


Fig. 7. First meta-space diagram based on the state diagram

Then, the spatial allocation made on the functional diagram was introduced in the meta-space diagram. Fig. 8 illustrates the activity groupings as performed by the programmer. For example, “borrowing” and “return” were considered to be done in the same functional space. This was a programmatic concept choice made in the early stage of the architectural programming. This was not an obligation but a functional organization made by the contracting owner. The meta-space diagram allows keeping a trace of this decision. As a result of this choice, cultural documents should go in and out from the same functional space. This is a new requirement that the architects have to consider. It is added to the already existing requirements on both activities.

Regarding the cultural document life-cycle, another viewpoint analyses the flows between functional spaces. Indeed, a document usually cannot move by itself between functional spaces. There is a person who will do it. From the staff viewpoint, the flow of documents is coloured in red. Public viewpoint represents the document flow in blue. Now, there is interesting information that appears. Documents are put away from the Information/Borrowing functional space to the Adult and Children section by the staff and taken in the other way by the public. Apart from this example, one side ways are quite important for building like hospitals to separate clean flows from dirty flows and called for different architectural solutions. Pressured rooms for example only permit inside air to go outside the space. This can be used to represent important requirements. When looking at the functional diagram, public flow have two side arrow lines and staff flow no arrow at all. Is there a meaning behind it? And if not, why bothering adding arrows that could overload the diagram?

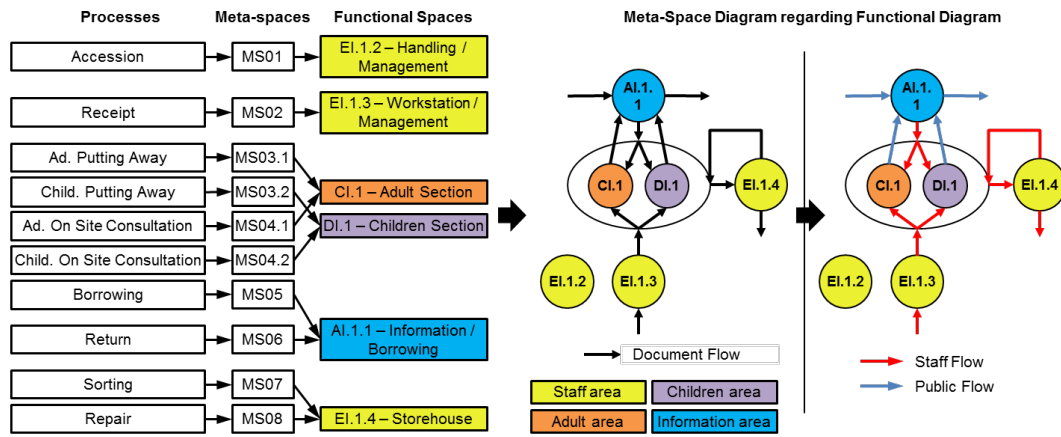


Fig. 8. Meta-space grouping and typology regarding the functional diagram

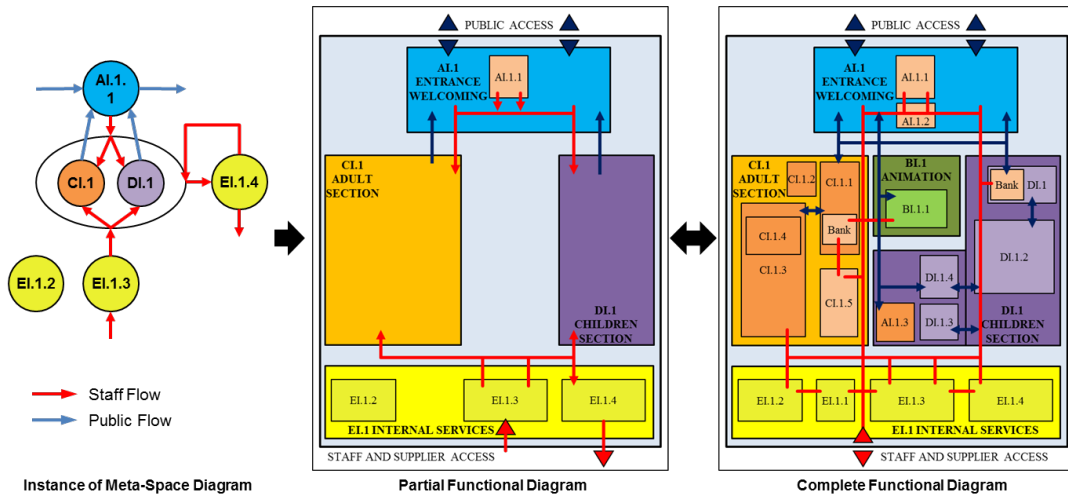


Fig. 9. From meta-space diagram to functional diagram with rationales

Then, the meta-space diagram of cultural documents life-cycle regarding the functional diagram was changed into a functional diagram using the graphics of the original functional diagram. By comparing the resulting functional diagram with the original one, some links were validated regarding the life-cycle of cultural document

(Fig. 9). Information not provided in the original one could be found in the partial functional diagram. As a matter of fact, the complete diagram should provide at least the same amount of information as its partial representation. By doing the same modelling of other processes, it could be possible to enrich the complete functional diagram with more relevant information related to flows.

Discussion/Conclusion

The meta-space diagram focuses on a limited set of functional requirements, those related to known and understood processes and activities. Then, there is a risk that only a narrow synthesis of the building is represented in the functional diagram. At least, it provides some rationales from functional requirements “easy” to define, but how about the others? This remains an open question for the perspectives of the project.

These design artefacts are easier to manipulate due to their high level of abstraction than activities or functional spaces. They enclose requirements related to each activity. Processing is done on meta-spaces regarding these requirements. Activities can be merged without losing requirements; meta-spaces keep everything inside. It allows requirements processing on activities the programmer will not think about for enhancing multi-functional spaces. The processing is currently handmade but could benefit from automation (Kamara *et al.*, 2002). Other existing approaches or tools (Kamara and Anumba, 2001; Flemming and Woodbury, 1995; Luo and Shen, 2008) could be related or integrated thereafter to or with it.

Application of meta-space diagram on the case study enables:

- an analysis of the flows regarding three different viewpoints (i.e. cultural document, staff, and public),
- a verification of the rationales behind a set of lines drawn in the original functional diagram,
- and an identification of requirements not covered by the original functional diagram.

However this application is based only on the modelling of a single process related to the life-cycle of a cultural document. Therefore, it gave a first validation of the value added of such an artefact in the context of analysis of the functional diagram. Meta-Space diagrams seemed to cover more requirements and provide several viewpoints on the building project. Each resource required by an activity could be used to provide another perspective on the meta-spaces dependencies then transposed in the functional diagram. Its higher level of abstraction made it a more comprehensive and flexible model for a requirements analysis and representation than functional diagram.

Though, this application was done partially and retrospectively on an existing building based on its brief, additional information and without the support of the contracting owner. To confirm these first results, the meta-space diagram would be applied on a broader case study in a more realistic context in the following months. The selected project is a university library in Luxembourg. It has its brief already done but the functional diagram is missing. As a result, spatial allocation and layout are not performed properly. The meta-space diagram will be used to synthesize the information contained in the brief and available from the contracting owner's representative. Then, the functional diagram will be designed based on possible grouping and the functional organization wanted by the librarian. This would help her

to affect functional spaces into the designed building. Two ways of performing it will be undertaken: with and without the meta-space diagram, and performed separately by the authors and by the representative.

Acknowledgements

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The application of COBie to Increase the Functionality of Existing Facilities Management Software

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Abstract

Building Information Modelling (BIM) can provide a focus on collaboration between the designers, constructors and facility management (FM) personnel leading to major efficiencies in the operational and maintenance phase of a building. The information within a model can be extracted at various stages throughout the project life cycle using the Construction-Operation Building Information Exchange (COBie) schema that provides an open framework for the exchange and delivery of construction handover information. However, it is then up to the FM software companies to take the information and display it in a user friendly way. The authors have set about enhancing an established FM software package, which more efficiently transfers the equivalent of multiple documents. This gives the user a front end view of all of the information that has been captured over the construction period, resulting in the FM having all of the information available at their fingertips in a visualized database, which greatly assist the operational maintenance of built assets.

Keywords

Building Information Modelling, COBie, Facilities Management.

Introduction

Today, most contracts require the handover of paper documents containing equipment lists, product data sheets, warranties, spare part lists, preventive maintenance schedules, and other information. This information is essential to support the operations, maintenance, and the management of the facilities assets by the owner and/or property manager (East, 2012). Operating and maintaining high performance buildings requires a sophisticated organization with careful preparation and planning, requiring a well-managed project delivery system that can cater with complex business processes and an expert operation and maintenance (O&M) team (Ruiz, 2010).

The challenge for the future is to optimize FM and to find solutions for supportive tools to help FMs operate and maintain their buildings more efficiently by including user behavior in the building process (Sabol, 2008). The same author further explains that FMs are continually faced with the challenge of improving and standardising the quality of the information they have at their disposal, both to meet day to day operational needs and to provide senior management with reliable data for organisational management and planning. In order for the FM process to advance and

meet day to day operational needs it is essentially that a more efficient method of generating and managing building data during the life cycle of the building is explored. This process is now more possible with the increased sophistication of BIM tools, which has the ability to offer a new level of functionality for the management of buildings and the physical assets within them. BIM tools have matured to provide a unified digital repository of all building components, and as a full 3D model it is capable of displaying views with a clarity that typically eludes users not schooled in interpreting standard 2D building drawings (Sabol, 2008).

The BIM model retains information such that is invaluable in the operational and maintenance phase of a building, as today most contracts require the handover of paper documents containing equipment lists, product data sheets, warranties, spare part lists, preventive maintenance schedules, and other information which the BIM model contains routinely as rich data. This information can be then extracted from the model using the COBie schema, which provides an open framework for the exchange and delivery of construction handover information. The purpose of this paper is to outline how an established FM software product can be enhanced by integrating BIM and COBie data, thereby displaying the information in a more user friendly way for FMs.

Methodology

The methodology involved action research combining theory and practice through change and reflection in an immediate problematic situation, within a mutually acceptable ethical framework. Action research is an iterative process involving researchers and practitioners acting together on a particular cycle of activities, including problem diagnosis, action intervention, and reflective learning (Avison et al., 1999). At the time of completing this paper the software was under review and validation and may undergo further improvements as a result of feedback from users in the field of FM.

Types of Building Information

For large construction projects, an extensive amount of information must be included in the handover file. The building documentation is usually compiled by the main contractor on the project. The Project Supervisor Design Process (PSDP) is the person who has to handover the safety file. The main contractor usually includes this in their handover file. The clients' requirements will depend on the level of detail that must be incorporated in the file. The clients, who have a hands-on approach and are involved in the project, will normally require a more detailed file at the end of the project. The type of information that is ordinarily associated with project information is as follows:

- Design Team Documentation;
- Building Structure;
- Fabrics & Finishes and
- Mechanical & Electrical Services:

The quantity of information that is required in the O&M file can be quite extensive. With this large amount of information it is easy to omit or misplace documentation. It is difficult to get every discipline to include all information associated with their system. For this reason, the main contractors and PSDP are outsourcing the compilation of these files to specialist contractors. These specialists have developed

software to use to compile the files. A problem that these specialist contractors face is to ensure that all of the information is contained within the file. The reason for this is that the specialist contractor compiling the files are not involved in the actual design or construction of the project, and, are usually brought onto the project near the end. This means that they are reliant on the subcontractors and designers to provide all of the required information.

There is a growing interest in how BIM can be leveraged to streamline the operations and maintenance of existing buildings. This includes questions about how BIM tools, created for the design, planning and construction phases of a project, can be used for data exchange with owner organisations and for O&M activities. (Anderson et al, 2012). Langdon (2012) outlines a number of benefits in the FM field when a BIM model is in use at the design and construction phases of a project. These include the

- creation of an FM database directly from the project (as built) model;
- ability to perform FM costing and procurement from the model; and
- ability to update the model with real-time information on actual performance through the life of the building.

In regards to FM and BIM probably one of the most exciting developments to come from combining both processes is the COBie schema. The COBie approach envisions capturing information incrementally throughout the planning, design and construction processes and providing a framework for robust information organisation for FM (Sabol, 2008).

Construction-Operations Building Information Exchange (COBie)

COBie can be used to capture and record project handover data. The COBie format facilitates the delivery of building information during planning, design, construction, and commissioning for delivery to facility owners and operators (buildingSMART Alliance). This standard allows retrieving process specific IFC-based facility data but uses spreadsheets to view and store this data (Taneja et al, 2010). The COBie schema provides an open framework for the exchange and delivery of construction handover information (East, 2007). COBie as explained by Mills (2010) was a prototype model proposed for US government facilities and is IFC friendly but functions within desktop software applications e.g. spreadsheets, digital images, and PDF's. COBie identifies the contents deliverables for information exchanges during design, construction, commissioning, and closeout and archives them in a spreadsheet. The COBie approach as outlined by East (2012) is to enter the data as it is created during design, construction, and commissioning as detailed in see Figure 1.

Designers can provide floor, space, and equipment layouts, whilst contractors can provide make, model, and serial numbers of installed equipment. Much of the data provided by contractors comes directly from product manufacturers who can also participate in COBie data population. The three main stages that the COBie information falls into are as follows:

- **Design:** During the design stage the room areas, sizes, layouts and construction details are decided. All of the information associated with these aspects should be inputted into the model. At the end of this stage a spreadsheet can be produced with all of the rooms and areas in the building with associated room names, tags, etc.

- **Construction:** The designed model is taken by the construction team where makes, models, serial numbers, contact details and O&M information is linked into the COBie spreadsheets. They simply have to link the information to the equipment which has already been selected by the designers. By linking all of the manufacturers' technical data, O&M / User guides on equipment, the contractor is basically compiling their operation and maintenance manual as they go, rather than the process just being rushed at the end of the project.
- **Commissioning:** The commissioning stage is when all the as-installed or as-built information is entered. Commissioning and testing records are inserted into the spreadsheets. The final as-built drawings are also produced and attached to the spreadsheet.

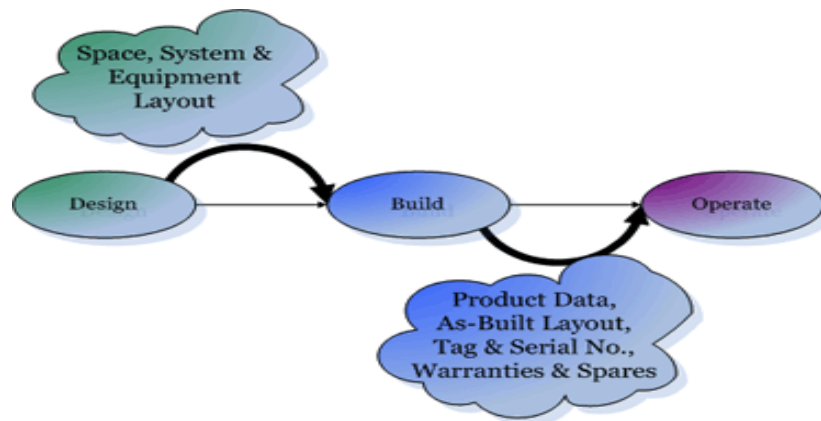


Figure 1 – COBie Layout

However, if BIM and COBie are adopted, we need to not only streamline the flow of information between programmes, we need to address the interface for facility services crews, so they too can leverage these new datasets. Time spent training with new technologies and grappling with complicated interfaces means less time on the physical systems that need their attention. (Anderson et al. 2012). The authors add that as more digital information is amassed; including information from COBie and BIMs, organisational cultures and practices need to be developed around these new datasets.

Case Study Software: InControl DFM Software

Moore DFM has been compiling documentation since its formation in 2004. It has developed its own software for compiling digital building files. A problem that the company faces is to ensure that all of the information is contained within the file. The reason for this is that the specialist contractor compiling the files are not involved in the actual design or construction of the project, and are reliant on the subcontractors and designers to provide all of the required information.

InControl DFM has been developed by InControl Ltd trading as Computech Ltd. It is a FM software application that can be used for various types of project handover documentation. It can be used for mechanical and electrical services O&Ms, building files and safety files. DFM is an interactive file that is used as an interface for all of the documentation on a project. It has been used as the digital building file for some

of the biggest projects in Ireland. The following are some of the projects on which it has been used:

- Convention Centre, Dublin
- Grand Canal Theatre and Office Development
- Spencer Dock Block C, R, STUV
- The Point Village Development
- St Vincent's New Private Hospital
- Blackrock Clinic



Figure 2 - Layout of DFM Software

Figure 2 above shows the O&M section of the DFM software. On the left-hand side (marked 1 above) is the system tree. This is where all of the project systems are set up. Information is linked here during construction of the file. In the middle of the figure (marked 2) are all of the tabs over which the information is spilt. During the construction of the file the information will be broken down into these tabs. On the right hand side of the figure (marked 3) are all of the base tables. This is where all the information is based. By clicking on the drawings link, the drawings for the entire project will appear. This is different to the system tree where clicking on a system will show only the documentation linked to that system.

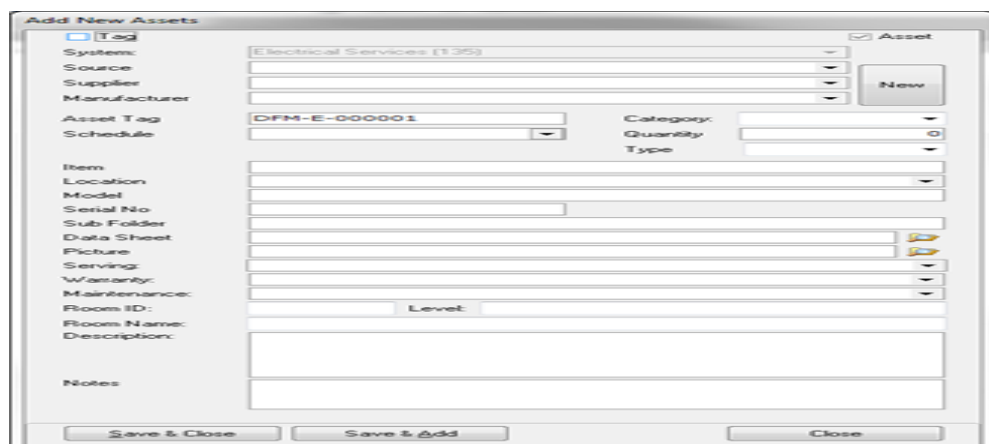


Figure 3 - DFM Asset Tab move text to make larger in size for clarity

The asset register is one of the main functions of the DFM software. Each asset is inserted into the system with information attached. This is to ensure that the end user

has as much information as possible to ensure the smooth running of the building. The figure below shows all of the fields of information available to be associated with an asset. Once all of the information has been inserted across each of the tabs, it is possible to create reports listing all assets, drawings, certificates, spares, etc. The authors have developed this FM software package which speeds up significantly the transfer of hundreds of documents between the COBie spreadsheet and the software.

The authors will demonstrate in the next section the potential ability to customize existing FM packages to ensure that only the most relevant information is exported from the COBie spread sheet. This gives the user a front end view of all of the information that has been captured over the construction period and ultimately means that from day one the facilities managers have all of the information available at their fingertips in a friendly and visualized database.

At present it is not possible to simply press a button within the BIM orientated program and get a COBie spreadsheet. At present toolkits exist that make it possible to input COBie fields against the elements as the model is built. The information will be imported into the spreadsheet to create schedules. These schedules can be exported to a simple text document. These text files must then be copied manually into the relevant worksheets in the COBie spreadsheet. This is not ideal as it takes time to export all of the information from the software to the text files and then into the spreadsheet. Even though this process might be laborious, it is a much faster process than manually typing all of the information into the COBie spreadsheet. The information is displayed in multiple tabs in the spreadsheet. The figure below shows the layout of one section of a completed COBie spreadsheet.

Figure 4 - Contact Tab in COBie Spreadsheet

COBie vs. InControl DFM.

The commercial software that has been used to create digital building files is called InControl DFM. The authors have examined all of the fields that are manually compiled and compared them to the information available in the COBie spreadsheet. A list of common fields was compiled and a map of data transfer was drawn out. This showed what information would flow between the COBie data and the FM software. Considering there was a lot more information in COBie compared to InControl DFM, not all of the data contained in COBie is directly relevant to the facilities side. Fields that are commonly used in FM software are shown in Table 2.

DFM – Asset Register Fields	
System	Asset Model
Source	Warranty Period
Supplier	Maintenance Period
Manufacturer	Room ID
Asset Tag	Level/Floor
Category	Room Name
Quantity	Description
Type	Serial Number
Asset Name	Link to Data Sheet / Information
Asset Location	Area Serving

Table 2 - DFM Asset Fields

After reviewing COBie, it was evident that all of the information that would normally go into a digital building file is contained within the spreadsheet. By importing this information into the InControl DFM it would create a full asset register of all the main plant items on the project. All of the operation, maintenance and technical data on the assets are stored in the Documents Tab in the COBie spreadsheet.

Importing COBie information into DFM Software

At first it was expected that it would be very easy to link information from the COBie spreadsheet into the DFM software. The problem in transferring the information across from one to the other is the “language used”. When looking across all the tabs in the COBie spreadsheet, the same “Name” or “Ref” is not always used. A variant of the original name is often used. While it is clear to the human eye that the information is linked, a computer is unable to recognise this. The software has parameters, filters and searches developed into its code to link information together. In order for the software to work it requires a field in all tabs to link the information together. An element code or reference for each main piece of plant, asset or equipment is required. This should not be site or project specific but common for every site and every project. In simple terms it should be a universal element numbering system.

As with most FM software, InControl DFM is based around an assets section. The assets section contains a lot of information about the element. If there are ten thousand files in FM software and only one thousand assets, the majority of those files will be associated directly with the asset. For instance, if you take a pump as an asset, it will have a lot of technical information associated with it and will not have just one document. You will have pump curves, operation data, maintenance data, spare parts lists, safety data, wiring diagrams, testing and commissioning data, etc. That means that one asset can have numerous files. Therefore, we will need to be able to link numerous documents to a single asset.

The actual process that the software follows to import the information from the COBie spread sheet to the DFM software is very straight forward.

1. The link software extracts each worksheet from the COBie excel file and creates a single CSV file for each.
2. Then, using map files and the individual CSV files, it imports the information from COBie into the DFM database.
3. Using SQL commands, it creates a link table between the systems and database.

The software uses map files to extract the information from the COBie spreadsheet. The authors have created tables in Microsoft Word mapping out how the information should be interchanged between the spreadsheet and the DFM software. Within the DFM software there are nine different categories that information can be linked into. This resulted in the creation of nine map files for importing the information from COBie. All the documents and elements listed in the COBie spreadsheet were imported into the DFM system. The three assets were imported with all their fields of information filled in automatically. The process is not just developed for use with the DFM software but can be taken and used to import COBie information into any FM software. The figure below shows all the fields that were automatically populated using the import software.

The screenshot shows the 'Assets' form in the InControl DFM software. The form is titled 'Assets' and has a 'Tag' checkbox on the left and an 'Asset' checkbox on the right. The 'Asset' checkbox is checked. The form contains various fields for asset information, including System, Source, Supplier, Manufacturer, Asset Tag, Schedule, Category, Quantity, Type, Item, Location, Model, Serial No, Sub Folder, Data Sheet, Picture, Serving, Warranty, Maintenance, Room ID, Room Name, and Description. The 'Data Sheet' field is populated with 'acrylic_mirror_technical_data_sheet.pdf'. The 'Description' field is populated with 'Mirror'. There are 'Save & Close', 'Save & Add', and 'Close' buttons at the bottom.

Figure 5 – Populated DFM Asset Table move text to make larger in size for clarity

Conclusions

With the slowdown of the world economy, all companies are trying to get ahead of their competitor. This means that most companies are trying to find niches in the

market or provide extra functionality compared to rival companies. If properly implemented, COBie can increase the functionality of an existing FM program. COBie contains within a spreadsheet all the information collected from construction that is handed over to the facilities department. This information can be accessed by clicking on the color coded tab within the spreadsheet. The authors have demonstrated how software companies can take all of these extra fields of information from COBie and provide it in their software. The software demonstrated this through the use of map files to extract the information from the COBie spread sheet. This gives the user a front end view of all of the information that has been captured over the construction period and ultimately means that from day one the FMs have all of the information available at their fingertips in a friendly and visualized database. This process was not just developed for use with the practiced software detailed within the research but can be taken and used to import COBie information into any FM software.

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The Production and Use of Steel for Building Construction

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Abstract

Steel followed and subsequently brought to a halt the success of its predecessors, cast iron and wrought iron. Its prominence came as a result of the Bessemer converter in 1855, a principle still being used in modern steel production. Steel is a versatile structural material because of its combination of high strength, good strength to weight ratio and wide range of material properties. This paper is a literature-based review of steel as a structural material used in building construction. It covers the steelmaking process, chemical composition of steel and heat treatments that result in a variety of engineering properties as well as the downstream processes of fabrication and construction. The history of steel is then discussed and linked to how the demand for this material has risen to present levels. This self-contained paper is used to inform a larger research on the environmental impact of steel buildings.

Keywords

Building, Construction, Steel, Steelmaking, Structural

Introduction

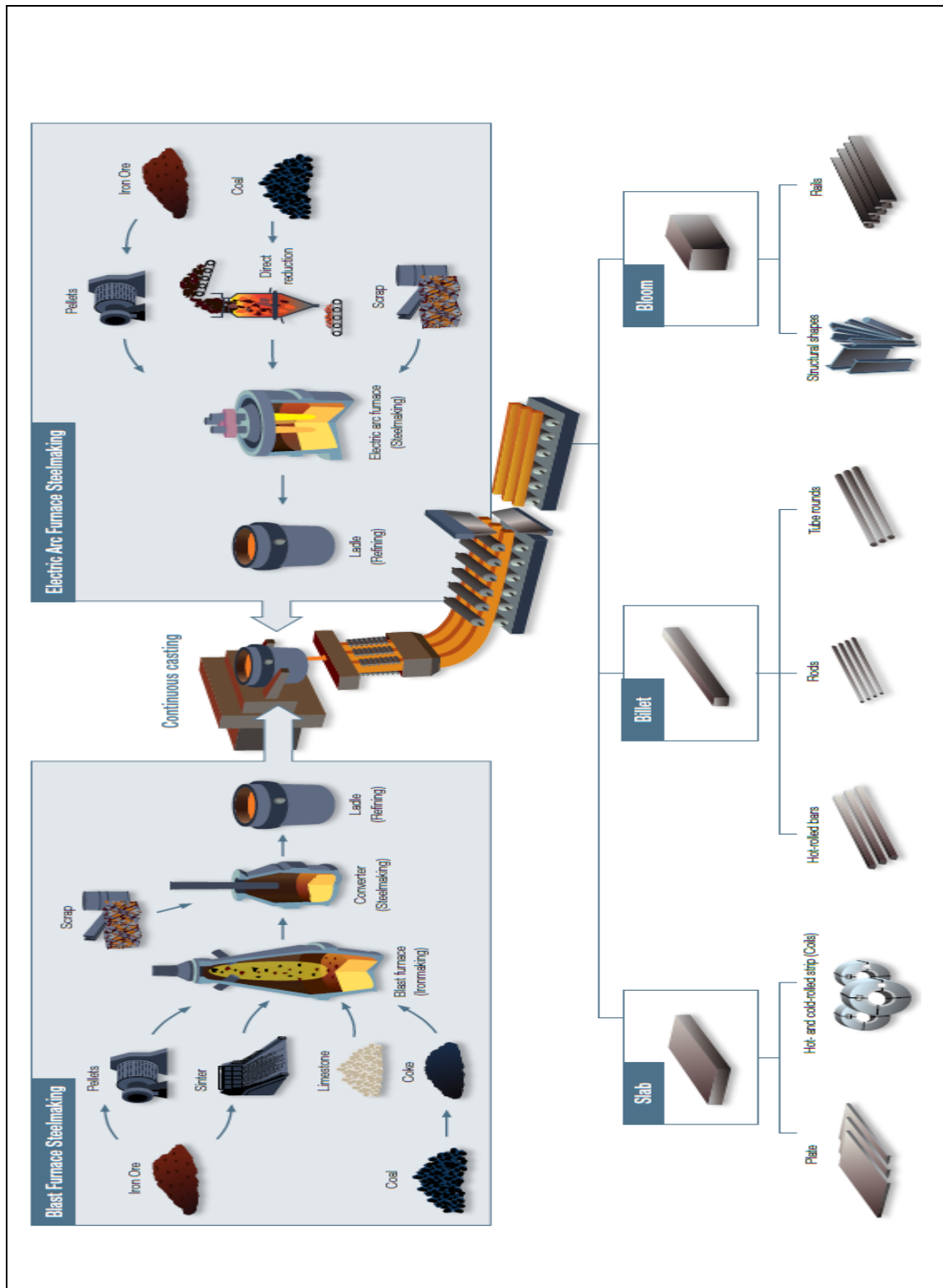
This paper explores the global production of steel and its use as a structural material in the United Kingdom (UK) building industry. The objective is to understand the fundamentals of steel production and its demand as a construction material. It is only through an in-depth understanding of past and present events that future trends can be predicted with relative certainty. Although this paper focuses on the current steel production processes and uses, it is part of a larger research on the environmental impact of steel in building construction. In spite of a wide range of properties and uses, Section 2 defines what steel is in the context of its structural use in buildings. The steelmaking process is then covered, including the impact of chemical composition and heat treatment on the engineering properties of steel. Downstream processes of fabrication and construction are also discussed. Section 3 reviews the history of steel and how the demand for steel has risen to its present levels. The amount and distribution of steel in present circulation are then discussed. The proportion of steel being used in construction is reviewed closely, with approximately 25% of the construction sector usage being structural sections used in buildings. The predicted future production levels are briefly discussed before the rationale for the main research is covered in Section 4.

Steel

Steel is a versatile structural material because of its combination of high strength, good strength to weight ratio, a wide range of material properties and product form, 100% recyclability, availability and affordability. It is an alloy of iron with a number of other elements added in small quantities to achieve a variety of chemical compositions. The stock products from the steelmaking industry are structural sections, bars and plates, which are transformed into useful products through manufacturing. A small proportion of steel production consists of heavy forging and castings (SCI, 2003). With strength levels ranging from 250N/mm² to 2000N/mm², steel can be formed into a wide range of different products. It has a constant modulus of elasticity up to yield strength but still has a high capacity of deforming plastically, making it a ductile material with good fracture toughness. Other useful properties include low thermal expansion and high melting temperatures (Allwood & Cullen, 2012). The main problems of steel in the construction industry are corrosion and fire resistance. Although normal structural steel maintains strength to 300°C, it progressively weakens at higher temperatures. Steel also needs to be protected from corrosion in adverse conditions. Both the hot strength and corrosion resistance of steel can be improved by chemical formulation but currently it is more cost effective to provide protection (SCI, 2003).

The steelmaking process

The term “steelmaking” is the process of transforming iron ore into stock products such as bars, plates and coils in the steel mill and the companies that carry out this work are described as the steel industry. Although variations exist, there are essentially three production routes for steel, namely the blast furnace-basic oxygen furnace (BF-BOF), the electric arc furnace (EAF) and the open hearth furnace (OHF). Owing to its energy intensity and severe environmental impact, the use of the OHF method is in decline with only four known furnaces remaining in existence today (Worldsteel, 2012b). Figure 1 shows an overview of the BF-BOF and EAF steelmaking process. Iron ore, coal and limestone form the bulk of the raw materials fed into the blast furnace. Hot air and traces of other materials are blown in from the bottom to control the chemical reaction, achieve the desired chemical composition and for deoxidisation, thereby reducing impurities. Coke, a sinter from heated coal, reacts with air to form carbon monoxide (CO), which in turn reacts with iron oxide to form iron and CO₂ (SCI, 2003). Slagging agents are added to the blast furnace to facilitate the removal of impurities from the iron ore. The resulting elements are a mixture of aluminium, iron, magnesium and calcium oxides, which are lighter than iron and so they float above the liquid metal. These slags form the bulk of steel by-products and can be pelletised, air-cooled or granulated depending on how they are cooled (SCI, 2003).



The materials react at high temperatures in the BF to produce molten iron with about 5-10% impurities. The pig iron is continuously collected into ladles at the bottom of

the BF, the majority of which finds its way into the BOF; the primary production route of steel from raw materials. However, a small amount of the molten iron is used in the EAF and OHF processes (Worldsteel, 2012b).

In the BOF, oxygen is blown through the molten iron thereby oxidizing the remaining carbon in an exothermic reaction and converting the alloy into low-carbon steel. The temperature in the BOF is controlled by the addition of recycled steel, with an average content of approximately 13% (Hammond & Jones, 2011). The refinement of the molten steel takes place in a separate ladle furnace.

EAF predominantly uses recycled steel, direct reduced iron (DRI involves the reduction of iron ore to iron in a rotary furnace heated up using natural gas or coal) and electricity. The recycled steel, together with the DRI or molten iron from the BF, are all fed in to the EAF. Electrodes, located above the metal surface, are lowered into surface to form a high temperature arc, with the metal acting as a conductor. Carbon, oxygen and other fossil fuels may be added into the furnace if the charge is not entirely recycled material, in order to facilitate the reduction reaction (SCI, 2003).

The liquid metal phase is the most energy-intensive process in steelmaking, which has instigated significant amount of research on energy-saving initiatives. These innovations are not a subject of this paper but, of the current production methods, the EAF is the most environmentally-friendly. This is because the EAF method uses scrap steel as its dominant raw material, cutting out the amount of liquid iron required from the blast furnace or direct reduced iron routes. Nevertheless, steel products are durable and remain in existence for a long time with an average life of 32 years (Allwood & Cullen, 2012). Consequently, recycled material alone cannot meet the present demand for steel and hence the share of each production route is about 70% BF-BOF, 29% EAF and 1% OHF (UK Steel, 2012).

The downstream processes for the three methods are similar. Modern practice allows for continuous casting of the molten steel to form solid strands that are subsequently cut into slabs, billets and blooms. This method eliminates the heat treatments and initial rolling required by the traditional ingot process (Worldsteel, 2012b). Casting involves the ingot production route. This is where the molten steel is cast into a mould and allowed to solidify before undergoing heat treatments by rolling to achieve the required properties. In forging, blooms are heat-treated and formed before undergoing mechanical pressing until the desired shape is achieved. There is a small proportion of steel production that still needs these casting and forging processes to be followed (SCI, 2003).

A significant amount of steel production involves rolling whereby steel is reheated to facilitate reshaping of the metal into desired profiles as it is passed through a series of mills with rolls. Strip and sheets are produced from slabs, rods and bars from billets and sections from blooms. Other processes such as cold-rolling and tempering can then follow if necessary. The stock products are then cut into the desired lengths, which can be supplied bare or subsequently coated for corrosion protection (SCI, 2003).

Chemical composition

As outlined above, steel is a metal alloy and therefore does not have a chemical formula. Equation 1 below lists the majority of the constituent elements whose presence and amount depend on the required type and properties of steel (SCI, 2003).



Where Fe – iron, C – carbon, Mn – manganese, Si – silicon, S – sulphur, P – phosphorous, Cr – chromium, Ni – nickel, Cu – copper, V – vanadium, Mo – molybdenum, Al – aluminium, Nb – niobium, Sn – tin, Sb – antimony, As – arsenic, O – oxygen and N – nitrogen.

Steel contains up to 1.67% carbon by weight, above which it is considered to be cast iron. Steel strength and hardenability (sensitivity to heat treatment) improves as the carbon content increases but ductility, which is the amount of movement that the material can undergo without breaking, reduces. Thus steel strength and ductility requirements conflict with each other. For structural steel, carbon content is kept low to maintain high ductility and weldability. However, traces of other elements are added to improve the rest of the mechanical properties although the stiffness, conductivity and density are unaffected (Allwood & Cullen, 2012).

The microstructure of steel is affected by manganese, chromium, molybdenum, nickel and copper. These elements perform the same purpose as carbon in increasing the strength of steel although to a lesser extent. Chromium, nickel and molybdenum have dual purposes as they are also used to improve corrosion resistance and hot strength. Indeed, the inclusion of nickel and chromium in large quantities results in stainless steel. Niobium, vanadium and aluminium are added in very small quantities for nucleation which, when the steel is subjected to heat treatment, promotes grain refinement and hence increases strength (SCI, 2003).

Non-metallic inclusions need to be restricted to very small amounts and carefully controlled as they may be harmful to steel. Phosphorous and sulphur are residues from the iron ore and may cause brittle fractures and cracking of welded joints if they are allowed to remain in large quantities. Arsenic, antimony and tin are other impurities that can cause temper embrittlement leading to poor fracture toughness. A high concentration of dissolved nitrogen and oxygen gases can lead to brittleness. The addition of aluminium and silicon reduces these gases to oxides, which can either remain in steel as solid non-metallic inclusion or removed as slag (SCI, 2003).

Heat treatment

Heat treatment involves the cooling of the liquid steel at a prescribed rate from a peak temperature, thereby affecting the microstructure and properties of the solid steel. As described above, traces of additional elements cause the resulting steel to respond differently to heat treatment. This has the effect of increasing the steel strength while retaining good ductility, fracture toughness and weldability by keeping the carbon content low (SCI, 2003).

This process includes annealing (slow cooling of the metal in the furnace leading to coarse grained and softer final structure), normalising (natural cooling in air leading to

fine grained and high yield strength material), controlled rolling (normalising combined with rolling and then cooled freely in air) and quenching (rapid cooling by immersion in water or oil bath). Tempering is a second stage heat treatment whereby previously hardened steel is softened and allowed to stabilise into a more ductile and tougher material. Heat treatment can be applied after fabrication to relieve residual stresses in regions such as welded joints (SCI, 2003).

Engineering properties

BS EN 10025 (BSI, 2004) provides the specification for weldable structural steels. Low carbon steel grades of S275 and S355 are commonly used in the UK building industry. Besides strength, structural engineers need to know the steel composition and a whole host of other mechanical properties. Furthermore, details of the steelmaking process are required as different heat treatments exist for each production route. Table 1 below shows a variety of carbon steel properties and their typical uses.

Table 1. Carbon steel properties and typical uses (Allwood & Cullen, 2012)

	Alloy group	Composition	Processing	Typical properties	Examples of application
Carbon steels	Low-carbon	<0.25wt%C	Hot rolled and allowed to cool in air	Low to medium strength and moderate ductility	Structural beams for buildings, plates
	Med-carbon	<0.25-0.5wt%C	Heat treatment through quenching and tempering	High strength and moderate toughness	Forgings
	High-carbon	<0.5-1.0wt%C	Heat treatment through quenching and tempering	Very high strength	Rail, wire
	Cast-iron	>2.0wt%C	Cast to shape directly, possibly with heat treatment	Low strength and ductility	Large equipment and transport parts

The chemical composition is tested on a sample of the liquid steel taken before it is tapped into a mould. The results will appear on the test certificate of all products made from the same batch, with the products themselves stamped with reference markings. The test certificate includes the composition of the five basic materials, C, Mn, Si, S and P but may also include Cr, Ni, Cu, V, Mo and Al where applicable. The chromium and nickel weight content is provided for stainless and low-alloy steels (SCI, 2003).

The results of a tensile test, which include yield strength and elongation, are routinely included on the test certificate. Charpy test results are also provided when fracture toughness is considered necessary but this, and other additional chemical analysis tests, incur extra costs as they cause disruptions to the normal steel production process (SCI, 2003). Defects that develop during the steelmaking stage include shrinkage cracks and the inclusion of gaseous and solid impurities in steel. Additionally, surface imperfections and cold laps can appear in rolled products. These imperfections are

taken into consideration in structural design codes by limiting the permissible compression stresses of slender sections (Allwood & Cullen, 2012).

Fabrication

In the construction industry, the stock products from the steel industry are converted into useful components through fabrication. This fabrication process involves cutting, drilling, bending, forming, drawing, welding and painting resulting in steel components that are ready for assembly into buildings on site.

The basic processing requirements are cutting and drilling. Cutting is done using guillotine shearing for thin sheets of up to 15mm thick. Cold saws, abrasive wheels and flame cutting, using an oxyacetylene torch, are employed for thicker sections. Laser cutting is used for thin but intricate forms. Drilling is done through computer numerical controlled systems. For thinner materials, holes are punched through instead (SCI, 2003).

Welding involves the joining of two or more steel pieces through fusion. The temperature of the materials is raised to melting point to facilitate the fusion and a consumable electrode may be used as a filler material. The localised temperature gradient causes intense residual stress which can result in brittle fractures. The most common method used in the construction industry is arc welding, although other methods such as resistance, electron beam and laser welding exist (Taggart, 1986).

Bending, forming and drawing are typically required for reinforcement bars or the cold-rolling of tubular sections from flat plates. Cold working can also result in increased strength in steel (Allwood & Cullen, 2012).

Construction

A steel-framed building comprises steel beams (horizontal) and columns (vertical) sections. In the UK, floors typically consist of in-situ concrete on metal decking or precast concrete panels, although other floor types exist. Shallow or deep foundations, normally of concrete construction, are required and will depend on the ground conditions and building size. The focus of this research is the building superstructure, which uses structural steel sections for its frame. This section looks at the history of steel, quantity and distribution of current steel production, steel producing countries and companies, as well as the amounts consumed by the construction industry.

History of steel

Steel is an alloy of iron, the metal that facilitated the industrial revolution of the 18th Century. Steel's prominence came in 1855 through the invention of the Henry Bessemer converter, whereby hot air was blown through liquid iron in the furnace in order to remove impurities. This process was immediately adopted by the steelmaking industry, facilitating the mass production of steel and bringing about the second industrial revolution. (Worldsteel, 2012b).

This has resulted in affordable steel products, transforming steel from a precious metal to one of the most common materials of this era. Steel is now used in every sector including construction, machinery, automotive and transport. Apart from the change introduced by Robert Durrer in 1948, where hot air was replaced by oxygen for improved efficiency, the Bessemer process is still being followed in modern steelmaking (Allwood & Cullen, 2012).

By the turn of the 20th Century, there were large steelmaking companies in Europe and the USA, with production figures overtaking those of the UK (BCSA, 2006). As steel was a strategic national industry that benefitted from state support, national tariff barriers existed for a good part of the 20th Century until the formation of free trade areas in Europe and Canada.

The steady increase in production that followed World War II was affected by the 1974 global energy crisis as shown in Figure 3. Together with a saturated market in developed countries, the crisis brought growth in steel production to a halt in the 1980s (BCSA, 2006). The revival in demand came in the 1990s through developments in China, which in 2009 consumed about two thirds of the global iron ore. A steady growth has been maintained by demand in other developing regions, particularly in the other BRIC countries of Brazil, Russia and India.

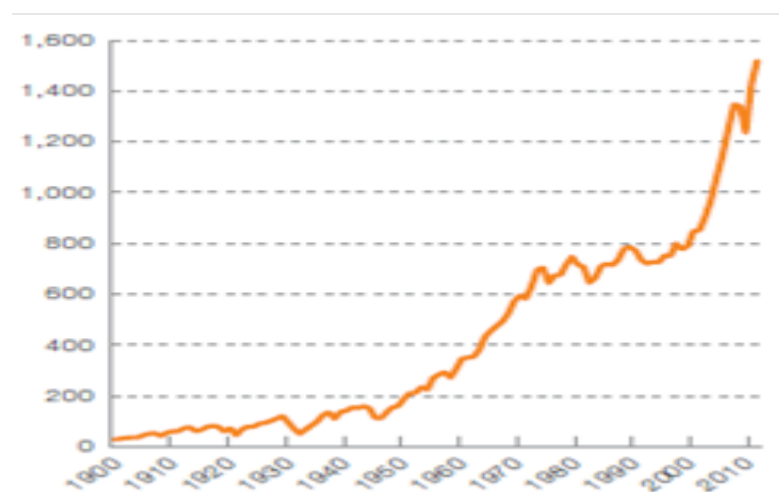


Fig. 3: steel production growth rate in million tonnes (Worldsteel, 2012b)

The fall of the Soviet Union led to a spate of privatisations in the early 1990s. Major acquisitions and mergers have recently led to the creation of global conglomerates such as ArcelorMittal. At present, China is the centre of attraction for trade in all things metal. It is importing ores from Australia and Brazil, machinery from Australia and Europe, scrap metal from the USA, steel and iron from Australia and Europe and, in return, exporting vehicles to the rest of the world (Allwood & Cullen, 2012).

Current Production Level

Tables 2 to 4 below have been developed or extracted from the 2012 edition of *World Steel in Figures* (Worldsteel, 2012c), which provides comprehensive statistics on the steel industry including production, use and trade.

Table 2. Crude Steel production 2011 by Continent (data from Worldsteel, 2012c)

Continent	Steel Production (Million Tonnes)	Percentage	Comment
Europe	215.1	14.2%	177.2 in EU (27) [82.4% of Europe]*
C.I.S**	113.5	7.5%	68.9 in Russia [60.7% of CIS] and 35.3 in Ukraine [31.1% of CIS] [Together =91.8% of CIS]
North America	117.5	7.7%	86.4 in United States [73.5% of North America]
South America	49.3	3.2%	35.2 in Brazil [71.4% of South America]
Africa	15.6	1.0%	7.5 in RSA [48.1% of Africa] and 6.5 in Egypt [41.7% of Africa][Together = 89.8% of Africa]
Middle East	20.8	1.4%	13.2 in Iran [63.5% of Middle East] and 5.3 in Saudi Arabia[25.5 of Middle East][Together = 89.0% of Middle East]
Asia	974.9	64.2%	683.9 in China [70.2% of Asia], 107.6 in Japan[11.0% of Asia], 71.3 in India [7.3% of Asia] and 68.5 in South Korea[7.0% of Asia][Together = 95.5% of Asia]
Oceania	7.2	0.5%	6.4 in Australia [88.9% of Oceania] and 0.8 in New Zealand[11.1% of Oceania][Together = 100% of Oceania]
Total World Steel	1517.9	100%	China produce 45.1% of the world's steel
*EU (27) = the main 27 countries that make up the European Union			
**CIS = Commonwealth of Independent States (former Soviet Republic)			

China's steel production, which makes up nearly half of 2011 global steel production of 1518Mt, is about seven times more than its nearest rival and 72 times that of the UK as shown in Table 3.

Table 3. Major steel-producing countries (Worldsteel, 2012c)

Index	2011	
	Country	Amount of steel product (Million Tonnes)
1.	China	683.9
2.	Japan	107.6
3.	United States	86.4
4.	India	71.3
5.	Russia	68.9
18.	United Kingdom	9.5

The major steel producing companies include ArcelorMittal and Hebei Group as shown in Table 4.

It is curious that ArcelorMittal only accounts for 6% of the global production, which is more than double that of its closest rival. Conversely, the mining industry is much more consolidated with the top three companies, BHP Billiton, Vale and Rio Tinto, accounting for more than a quarter of the global market (Allwood & Cullen, 2012).

Downstream of the steelmaking industry, the construction market is predominantly served by many small companies.

Table 4. Top steel-producing companies (Worldsteel, 2012c)

Index	2011	
	Country	Amount of steel production (Million Tonnes)
1.	ArcelorMittal	97.2
2.	Hebei Group	44.4
3.	Baosteel Group	43.3
4.	POSCO	39.1
5.	Wuhan Group	37.7

4.12 Use and distribution

About a quarter of the 7 billion world population has inadequate housing with nearly 100 million homeless. Population is set to grow to 9 billion by 2050, with more than 50% predicted to be living in cities (UNDESA, 2009 cited in Allwood & Cullen, 2012). The steel industry makes a major contribution to the building sector, which currently accounts for 20% of global emissions (Mertz, 2010).

According to Worldsteel (2012b), there is a link between steel and economic growth. It suggests that personal steel stock increases as the wealth of an individual increases. In developed countries, individual steel stocks have stabilised at a plateau ranging from 8 to 12t/person as shown in Figure 4. Any further increase is likely to be small because, in these countries, people are replacing rather than buying new steel stock. The UK has a stable steel stock of approximately 10t/person, with an annual replacement rate of 0.4t/person (Allwood & Cullen, 2012).

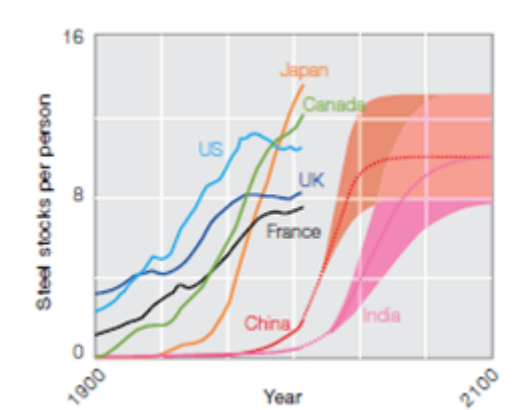


Fig. 4. Predicted steel consumption per capita (Worldsteel, 2012b)

In addition, Figure 4 shows that steel stocks are posed to increase exponentially in developing countries such as China and India, whose current consumptions are approximately 2t/person (Muller et al., 2011). This rise in demand will lead to an

increase in the global production figures. As the world population is predicted to reach 9 billion by 2050, steel production is anticipated to have risen by 1.7 times to approximately 2500Mt per annum. About 1500Mt of this amount is expected to be from primary (iron ore) production and the balance from secondary (recycled) production. Mainland Europe still prefers concrete frames for its multi-storey buildings whilst Japan prefers flexible steel frames in its earthquake-infested region. Construction steel consumption therefore varies from approximately 3t/person in France to 9t/person in Japan with the UK, which also prefers steel-framed high-rise buildings, being about 4t/person (Allwood & Cullen, 2012). The 2011 average global steel use per capita is 218kg, which is the total steel production divided by a world population of around 7 billion (Worldsteel, 2012a). Table 5 below shows the apparent steel use per capita figures for the top five countries. The UK per capita consumption figure, which is below the world average, is also included for comparison purposes.

Table 5. Countries with the highest apparent steel use per capita (Worldsteel, 2012a)

Index	2011	
	Country	Apparent steel use per capita (kilograms)
1.	South Korea	1,156.6
2.	Taiwan, China	784.4
3.	Czech Republic	595.7
4.	Japan	506.7
5.	Germany	479.6
-	United Kingdom	148.6

UK consumption is one of the lowest in Europe because the calculations are based on national production rather than consumption levels. Having outsourced the majority of its steel production to developing countries, the UK now only produces less than 10Mt (UK steel, 2011). However, UK imports a significant amount of steel stock and products. After all the parameters (internal production, imports, exports and wastage) are considered, Allwood & Cullen (2012) estimate that ultimate UK consumption is around 28Mt, which pushes the per capita use up to 450kg. Clearly, the UK is grossly underestimating its emissions and should either import less steel or help developing countries reduce their emissions. On the other hand, the actual consumption figure for South Korea is significantly lower than that shown in the table above as this is due to its high export volumes of steel-containing goods.

Global usage can be categorised into the four main groups of construction, transport, industrial equipment and consumer goods. Consumer goods include domestic and office items such as cabinets, washing machines and cans for tinned foods which take up 14.5% of global steel production. The transport sector consumes 16.8% of global steel and is dominated by vehicles and ships, with trains and planes consuming only a smaller proportion. Industrial equipment accounts for 17.5% of global output and this includes paper mills, sewing machines as well as construction equipment such as cranes, drills and bulldozers (Worldsteel, 2012b).

More than 50% of global steel production is consumed by the construction sector and is broken down as summarised in Table 6. For buildings, steel use includes structural sections, reinforcement bars and steel sheet products.

Table 6. Percentage breakdown of steel usage in the construction sector (Allwood & Cullen, 2012)

Construction Sector	Percentage Usage (%)	Comment
Buildings	42	25% is structural sections; 44% is reinforcement bars; 31% is sheets products (e.g. cladding, purlins).
Infrastructure	14	24% is structural sections; 54% is reinforcement bars; 6% is train rails; 16% in pipes.
Steel for structures such as electricity towers and cranes is in addition the above figures.		

The largest proportion of steel in this sector is used for reinforcement bars in concrete construction. All types of buildings, stadiums, bridges, ports and stations use steel in the form of structural frames. The remainder of the steel used in buildings is for elevation and roof cladding, including supporting rails. In infrastructure, a small fraction of steel output is used for rail tracks and pipes for the distribution of utilities such as water and gas. Table 7 shows an approximate percentage breakdown of steel usage for buildings and infrastructure.

Table 7. Percentage breakdown of steel usage for buildings and infrastructure (Allwood & Cullen, 2012)

Steel construction		Proportion of the construction sector (%)	Breakdown (%)			
			Reinforcement bars	Structural sections	Cladding	Pipeline
Buildings	Commercial	22	8.8	6.6	6.6	
	Industrial	25	1.2	10	13.8	
	Residential	16	14.4	1.6*		
	Other (Schools, hospitals, stadiums,)	12	8.2*	0.9*	2.9*	
Infrastructure	Road and rail	18	10.8	7.2		
	Utilities	7	3*			4*
Total		100	46.4	26.3	23.3	4
*Estimate by author						

Rationale of main research

The state-of-the-art research carried out in this paper will be used to inform a larger piece of research on the environmental consequences of structural steelwork in building construction, which will be carried out in three parts. The first part will involve a literature-based review of building level assessment methods such as BREEAM to verify that the correct approach is being utilised for steel buildings. The second stage will involve a compilation of environmental data inventory for the UK building industry. This will be based on information from existing databases,

complemented by data to be collected from the UK industry. The final part will utilise the data collected from previous stages to develop typical environmental profiles, for different structural arrangements, that can be employed at project inception stages. Thus, this paper provides the fundamental appreciation of the steel production process, its history, drivers of its demand, the main players in terms of production and consumption as well as sector and geographical distribution.

Conclusion

This purpose of this paper was to gain an in-depth understanding of steel production and the current trend in its distribution and use. This helps to predict both adverse and beneficial impacts and makes it simple for policy-makers, researchers and the industry to set clear targets and future priorities. Methodical economic, social and environmental solutions can be targeted without major cost impositions. The outcome of this paper informs a larger research on the environmental impact of steel in building construction.

Steel has come a long way but its transformation to the most common material of this era was brought about by the Bessemer converter. This is influenced by the wide range of properties and product form, making it a versatile material used in every sector including construction, transport, industrial equipment and consumer goods. In construction, steel is used as reinforcement, structural frames and sheet products.

The UK has seized to be a major producer of steel. However, it is still importing a significant amount of steel products, making its usage per capita higher than the average global figure. Furthermore, a large fraction of multi-storey structures in UK utilises steel frames unlike its European neighbours, who still prefer concrete framed buildings.

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Digital Delivery of Infrastructure Projects; Impact and Management Issues Within a Project-Based Engineering Firm

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Abstract

The use of digital technologies for engineering design is receiving rising interest by both academia and the architecture-engineering-construction (AEC) industry. In the UK the government's new construction strategy to achieve fully collaborative BIM projects by 2016 is a further catalyst. Research in the field is too often focused on digital technologies and associated digital practices as implemented in major projects. Longitudinal case-study research is used to understand the impact and management issues associated with digital delivery of projects within a large international engineering firm. The data shows that technologies to manipulate and manage engineering data, communication and information infrastructure, and digital data standards are emerging as digital infrastructure for the firm's engineering design work; this digital infrastructure is in-complete and it takes the form of foundation systems to enable standardized ways of working across the different parts of the project-based firm, while leaving room for customization to meet the specific needs of different market sectors, projects and clients. The findings of this research improve our understanding about the digital infrastructure for project delivery and the tension between standardization and flexibility within project-based environments, and hence contribute to research on technology and organizations.

Keywords

Digital technology, infrastructure, management, project delivery

Introduction and theoretical framework

Digital technologies in the form of shared databases and repositories, software applications, digital tools and systems, and digital data standards are becoming integral component for engineering project delivery. The emergence of integrated project delivery (IPD) and building information modeling (BIM) concepts emphasize the role of these pervasive technologies as combinatorial innovation as well as digital platform for the firms who are engaged on design and engineering of infrastructure projects (Youngjin, Boland Jr et al. 2012) rather than being treated as separate technologies, and this has several implications for research and practice. In the UK the government's new construction strategy to achieve fully collaborative BIM projects by 2016 is a further catalyst (Strategy 2011), and hence firms are investing on the development of these digital platforms and capabilities in order to meet the goals of the government initiative and remain sustainable in a competitive market.

Growing body of research is articulating the impact of using digital technologies for design and engineering of buildings and infrastructure, (Dodgson, Gann et al. 2007) describe how digital technologies improve engineering design by providing learn-

before-doing opportunities for engineers, (Whyte and Lobo 2010) demonstrate how the digital infrastructure for delivery enhance design coordination for project work, and (Gal, Lyytinen et al. 2008) show how digital technologies facilitate cross-organizational communication. Moreover, scholars observing practices during the introduction of digital technologies for major projects has found that these technologies induce innovation across multiple professional communities (Boland, Lyytinen et al. 2007), and disrupt the ecologies of practices resulting in new hybrid practices that combine the traditional physical with the emerging digital practices (Harty and Whyte 2010). This growing body of research is useful for the understanding of the implications of the introduction of digital technologies for engineering design project work; there is an urging need to take the research on digital technologies beyond the project level to consider the implications, management and practices associated with these pervasive technologies within the firm on its totality.

Firms within the architecture-engineering-construction (AEC) industry follow the project-based form of organizing, which found most suitable to manage their complex products and systems (Hobday 2000). In a project-based firm profits and values are generated by professionals working in projects who are usually based off-site and working in teams with other firms, they operate at the boundaries of the firm and have weak ties with the main stream organizational structure and control mechanisms (Gann and Salter 2000; Scarbrough, Swan et al. 2004). This form of organizing has important implications on the management of digital technologies.

Previous studies found that project-based firms within various sectors have the potential to support innovation through different ways. (Keegan and Turner 2002) found that professionals working on multiple projects simultaneously and over time plays the role of boundary spanners and broker new knowledge and ideas, also free and intense communication and information flows through formal and informal ways blur the boundaries between functional groups within the firm and improve integration, moreover, decision making within this form of organizing is based on expertise rather than positional authority. However, and despite these benefits, construction project-based firms continue to struggle to manage innovations, (Gann and Salter 2000) found that construction firms *fail to build links between operations at the project level, portfolios of projects, and central routine activities*.

The tension between the project and the firm levels of analysis when considering innovation adoption and management has been highlighted in previous research as one of the main implications of the project-based form of organizing. (Gann and Salter 2000) emphasize the importance of understanding the differences and intersections between the more routinized business process at the firm level and the temporary and unique project processes when considering innovations in construction, while (Harty 2008) promote the concept of bondedness to account for the messy and complex dynamics of construction work. The consideration of this tension between firm-level and project-level processes and the differences between them is important when studying the introduction of technology for project work within large engineering firms who are engaged on the delivery of infrastructure projects.

The management of technology in project-based firms made difficult by the dynamic and evolving nature of the technology and associated working practices at one hand, and the idiosyncratic and complex nature of the project-based form of organization in the other hand. The aim of this research is to address this challenge through describing

the digital technologies used for project delivery and articulating the associated management practices, drawing from a longitudinal case study within an engineering project-based firm.

The paper is organized as follows: section 2 describes the research design and approach including overview of the case study firm and the data collection and analysis methods. Section 3 presents the findings of the case evidence through the description of the different elements of the digital delivery of infrastructure projects within the firm and its associated management challenges. Section 4 discusses these findings in relation to the literatures on construction project-based firms and digital infrastructure, and concludes with the implications of this research on practice and theory.

Research methods

The design and development of this research follows an engaged scholarship approach, this is a participative form of inquiry where researchers involve others (practitioners and other stakeholders) and leverage their different perspectives to learn about a problem domain (Van de Ven 2007). The research process iterates between the four elements of the engaged scholarship model (problem formulation, research design, theory building and problem solving) involving the case study firm as research partner rather than research object. Furthermore, this case study adopts iterative and multiple data collection instruments in an inductive manner to enable theory building from empirical data (Eisenhardt 1989).

The case study firm

The case study firm is an international engineering firm that specializes on planning, design and management of buildings and infrastructure. The firm currently consists of:

- a- 3 global practice areas (development, natural resources and transportation), with several market sectors within each of these practice areas, for example transportation include: rail, airports, highways, tunnels and underground spaces, and bridges. Various skill groups provide the technical resources to these market sectors and engage on project delivery activities, and
- b- Central corporate and support services: group business development, human resources, security, finance, secretariat, health and safety, IT and corporate communications, amongst others. These corporate services provide support for the practice areas across the different parts of the firm.

As such the organizational structure of the firm follows a project-based form of organizing.

Within this loosely coupled organizational structure technology was embraced within each practice area and market sector differently, some groups were more advanced on their use of technology than others, depending on various factors such as clients' requirements, complexity of work, available skills and knowledge and awareness of technology and its benefits. Some groups were heavily relying on simple tools and applications such as excel sheets for modelling and simulation of information, while others, such as the transportation business group for example were using sophisticated software packages for the production of engineering designs as well as for data

management and collaboration, this has been attributed to the strict compliance and systems required by the clients of this market sector.

In general the firms' projects are delivered through two types of professional work:

1. Business development and marketing (or bidding): this work is performed by groups of professionals who are responsible for identifying and working on bids to win projects at regional level. To achieve this they need to work towards meeting clients' and local needs norms and laws. They need to weight profit and loss with resources and investments. Most of the engineering design work at this level is conceptual with the need to demonstrate technological capabilities that will be used later after winning the project and this normally include examples from other projects and available resources within the wider firm.
2. Project delivery: and this comes following the successful winning of bids, and where the actual activities of project delivery takes place, engineers and technicians interact with other stakeholders outside the firm in engineering work that involve myriad of digital technologies that vary on its sophistication and capabilities to develop and produce design solutions. Productivity and quality of delivery are the main issues at this stage, the use and management of technology at the project level is vital to achieve these issues.

Moreover, to support the above project work, there are centralized technical services to maintain the firm's information infrastructure that enable communication, coordination and information management, as well as other consulting services provided by specialized groups such as finance modeling.

Data collection and analysis

This research project started on November 2009, the first data collection phase was started with a pilot study on June 2010, followed by two phases of data collection over the summers of 2011 and 2012, and the research is still on going. The evidence presented in this paper is collected through: 28 semi structured interviews with engineers, CAD professionals, technology managers, and directors, notes from attendance of 18 internal meetings which also include meetings for research design and report on progress, study of internal useful documents within the firm's intranet system, and numerous informal interaction through the days spent at the firm's offices. Also various materials about the firm and relevant websites were looked at during the course of the research.

The data analyzed qualitatively to understand the technology used for project delivery, and to seek interpretations for the use and management of technology from the evidence (Creswell 2003). Theoretical conceptualization overlapped with data analysis and literature reading. The interviews were transcribed verbatim, the content of the interviews assigned to codes using the qualitative data analysis software package Nvivo, the data analysis started with high level codes around: the digital technology, means by which knowledge about the digital technology transfer, and issues related to the firm as the social system within which technology and its practices spread. Then after, codes were refined, merged, and grouped while going back and forth through the data and themes emerged through the looking for similarities and differences within interviewees' statements.

The data analysis was more descriptive and exploratory to enable sense making of the technology, its management, and the context within which its practices are spread. 40 pages of field notes used to compare and contrast findings with the data from the interviews. Any clarification or new thoughts were added through the process of writing the findings. Facts and information found on related websites were used for general positioning and to make sense of the firm's markets and projects.

Digital technologies for engineering project delivery

Wide range of technologies is found to be used for project delivery within this large and international firm. The evidence from the case study has showed that digital delivery of infrastructure projects within this firm rely on three types of technologies: technology to manipulate and create engineering design data, technology to manage and enable collaboration when work with digital engineering data, hard infrastructure and communication technology, and digital data standards. The different stakeholders of the project engage on professional and collaborative work to deliver engineering design digital data that can be used later for construction and running of infrastructure projects.

These technologies have been described by technology managers within the firm as foundation systems for digital and global delivery of infrastructure projects; this is discussed by the technology management director interviewed in 2010:

“and therefore, we’re very much into putting in what we term the foundation systems that support elevated working methodologies and also will support BIM in terms of electronic document management systems, standard file naming, the ability to search and retrieve data”

These foundation systems are proposed to provide standardized ways of working that can be tailored, customized and upgraded to meet the specific needs of the various market sectors, projects and clients. These are illustrated on figure 1, and described on the following sections.

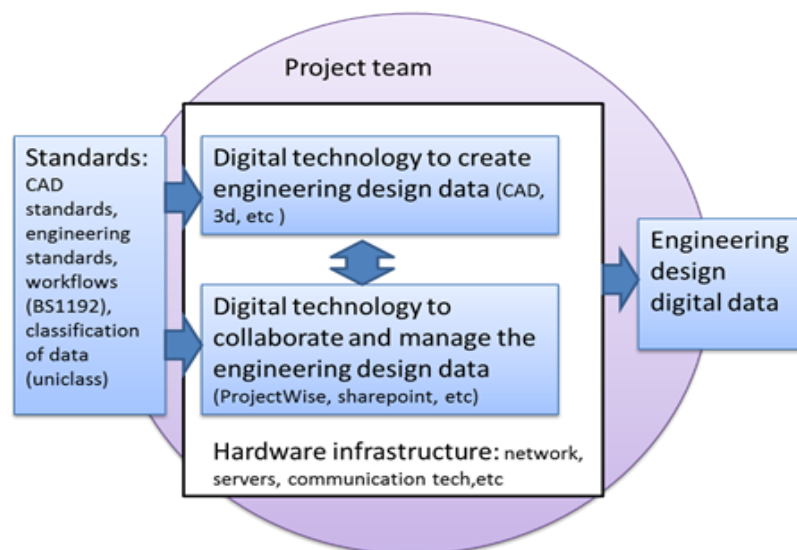


Figure 2: Digital technologies used for infrastructure projects

Technology used for the creation of engineering design data

Engineers and CAD technicians use wide range of technologies to manipulate engineering design data, in addition to the basic drafting applications such as CAD packages provided by well-established construction technology providers, engineers use discipline specific applications for more specialized engineering work, these tools are called bolt-on tools. The use of specific tools or applications depends on the complexity and the stage of the design as well as the knowledge of the engineer this is has been explained by a graduate engineer interviewed on 2011 as follows:

“we have got sort of three levels of software you could use, you could just use an Excell spreadsheet and some basic equations and that would be for your very simple approach. You could use something like X Disp which is....uses those same simple equations but because it’s got a nice user interface you can model on much more complicated situations or you can use Finite Element, Problem Finite Element Analysis such as Plaxis which I don’t know how to use but other people do, which models everything in much more detail and is theoretically much more accurate.”

The engineering work itself in the form of mathematical calculations or the physics of structural materials hasn’t changed overtime this why the old or simple technology is still in use beside the new and more sophisticated technology, and factors like the engineer’s experience or the value of the job decide on which technology to use.

The use of advanced engineering software applications and tools improved the outcomes of the engineering design process by the manipulation of available data to provide more accurate and closer to reality information as discussed by the same graduate engineer in 2011;

“it can provide reassurance that what you think is going to happen is likely to happen. That you have got some sort of mathematical and theoretical basis for what’s essentially sort of best engineering judgement. So if you expect something to move by 10 millimetres then you use a piece of software that tells you it is going to move by 11 millimetres, you know that you are in the right sort of area and that 10 is about right. So it’s sort of...rather than giving you the actual answer it supports your theory as it were.”

This knowing before doing has improved engineering design by providing the needed reassurance to overcome some design uncertainties; it also improved engineering design by eliminating problems at later stages of the design and construction

This kind of digital innovation is widely used within the engineering work and can be seen as institutionalised within the firm; however, standards to regulate and ensure the quality of it are developing such as the firm’s CAD standards, engineering standards that each engineering discipline needs to adhere to, as well as client-specific standards that are important to comply with.

Technology used to manage and enable collaboration in the creation of engineering design data

The project work of this firm is like other engineering design firm involves multi professionals from different locations working on one project or multiple projects at one time. Collaboration is an important aspect of the project delivery, digital technologies are used to enhance this collaboration, and yet, the use of technology poses challenges for the management of digital data in collaborative environments

following a consistent and timely manner. One example of challenges face engineers working on teams is confusion with drawing versions as described by water engineer interviewed in 2010:

“So they might work on the drawings of Revision C2, they rename it C3 they come back to it a week later do some changes put it at C4 and you issue it as C4. But you might not have issued C2 or C3. It’s just that they’ve, yes? So again that’s not so bad but people just query why they haven’t got revision C2 and C3 and straight to C4. Which is the confidence you need. Yes we tend to put clouds around revisions but when you go from a C2 to a C3 you’d delete the clouds for C2 and put new ones on for C3 so you might miss those.”

Technology to manage digital engineering data helps engineers to overcome collaboration challenges through the management of digital data produced by the technology described in the previous section, In addition to improved collaboration with engineering digital data, this kind of technology also provides assurance to clients that their project data has been managed following clear quality measures than can be proved:

“It (projectwise) provides a lot more assurance to clients like London Underground, that you have got a process that demonstrates people have checked it, and you can prove that the project manager actually opened the document and looked at it, which they like.”

An example of this is the management of CAD data through the use of software applications such as Projectwise which is emerging as the main tool for digital data management within the firm, it does not just provide repository for the project data, but it applies discipline to the way that data is created reviewed and shared, it also has a work flow engine built into it which follows BS1192 standard:

“That’s [projectwise] really our bread and butter collaboration tool for projects worldwide. Now this is going through a major development at the moment. Previously it has been relatively small scale in terms of the number of projects and the participation in those projects by the project teams being very UK centric and we are just beginning to see that taken up internationally”

As quoted above by systems manager interviewed in 2011, this technology is emerging within the firm, it is just started to be realized as important, user intervention and training are the main issues regarding the management of this technology. Technology managers need to engage on more activities to promote this technology and explain its benefits and how it can help improve project delivery. If data standards and workflows embedded within this kind of technology collaboration will be achieved successfully.

Hard infrastructure and communication technology

Technology always thought about as composed of soft part; that the software application, and hard part which is the hardware. To enable communication, information management and digital delivery the firm relies on hard infrastructure that is comprised of communication technologies such as telephony and video conferencing, as well as hard infrastructure in the form of: data centers, networks, servers, desktop and service desk management. Backup software and virus protection are also important.

This leading engineering firm is one of the early adopters of the OCS divergent technology which enables more collaboration through the means of shared text, voice and video facilities, this described by an IT support analyst interviewed in 2011:

“OCS is a big one. Unified communication. That’s made a big difference. So, next door you would have your email and you would have your land line and your mobile, now you know with unified communication all three are linked to each other so you use software on the desktop. You type in somebody’s name and you can call them. You know it’s so much easier. I think that has made a big difference”.

This type of technology is witnessing radical changes through the advancement of web technologies and the internet, cloud computing has the potential to override current hardware infrastructure by providing virtual versions of it which leads to cheaper and more accessible services.

Digital data standard

In this digitally-enabled collaborative engineering work digital data needs to be handled in standardized and consistent way. CAD standards provide consistent way of producing CAD drawings, while discipline-specific engineering data need to comply with specific standards to ensure quality of the engineering design solution. With the emergence of digital data classification and specification of this digital data is also important. Standards such as BS1192: 2007 are specifically developed to regulate and manage the collaborative production of architectural, engineering and construction information, and hence it is important to regulate the digital data of this collaborative work

Discussion and concluding remarks

The findings from this research have a number of implications. First, they describe the components of the digital infrastructure for the firm to support project delivery, these include technologies to manipulate and manage collaboration around digital engineering data, digital data standards and hard and communication infrastructure. This digital infrastructure is incomplete, it provides foundation systems that stand standardized ways of working across the firm which then can be configured and updated with the requirements of specific market sectors, projects and clients. The digital infrastructure evolves over time through the continuous engagement of the firm in projects and project work, this finding agree with Whyte and Lobo (2010) who claim that such infrastructure is not completed in one go, but rather is developed through work in particular projects and through drawing connections across projects, however, the evidence presented here demonstrate the digital infrastructure for the firm as a whole.

Second, the findings of this research account for the tension found in project-based firms between the routine centralized business process, and the more unique and autonomous project processes (Gann and Salter 2000) by providing the firm with incomplete digital infrastructure that offer standardization and customization at the same time, the provision of foundation systems for digital delivery of projects provide standardized forms of digital project work across the firm, and as discussed above, this standardized digital infrastructure stand as foundation that can be upgraded, reconfigured and customized to address specific needs of the different market sectors, projects and clients.

The contribution of the research presented in this paper is to describe digital technologies used for project delivery, and to articulate its impact and associated management practices. As described above, three types of technology were identified by the empirical data: technology to manipulate and create engineering design data, technology to manage and enable collaboration when work with digital engineering data, hard infrastructure and communication technology, as well as digital data standards, these digital technologies are described as foundation systems that can be used across the project-based firm as a standard ways of working which can be upgraded and customized into market sector-specific digital infrastructure. This is important because it improve the understanding about the emerging digital infrastructure for project delivery. It extends existing understanding of the impact of the use of digital technologies in major projects to account for the implications and management of these technologies within an AEC project-based firm. It is of practical importance for engineering firms facing new ways of digital work because it articulates digital infrastructure for global delivery of infrastructure projects across the different parts of the firm.

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The Socio-Technical Regime Networks Associated with the Implementation of Direct Current (DC) Electricity in the Built Environment

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Abstract

The use of direct current voltage in the built environment has a number of potential advantages. However, implementing DC voltage is not just a technical challenge; there are also many human interactions with the technical system that will be affected by such a change. This paper seeks to show how socio-technical systems theory can be used to characterise the different elements that affect the implementation of DC in the built environment. By presenting an initial mapping of the socio-technical system around electricity supply for the built environment, this paper identifies the actors, networks and institutions, and associated rules and regulations that constitute the regime networks that are associated with the electrical system in the UK. It has shown that some actors can function in more than one regime network and presents some of the interrelationships between the different network actors, all in a framework of increasing influence on the decision making process to implement DC voltage electricity.

Keywords

Alternating and direct current voltage, the built environment, socio-technical systems theory, regime network actors, niche innovations

Introduction

At this time the supply of electricity to the built environment is in the form of alternating current (AC) voltage and has been since the race between Edison and Westinghouse was won by AC voltage. For some of the history see Kinn (2011 pp. 11-12.). However for some specialised loads, DC voltage is still in use. For example it was only in 2007 that the last DC supply line was cut by the ConEdison company in New York, after which the DC loads were supplied from the AC network via a transformer (Lowenstein, 2008). Since the advent of the silicone chip and the development of power electronics (Meindl, 1997), the loads using electricity have developed from purely electrical to electronic applications. This means that more and more loads actually consume DC electricity, even though they are supplied by AC. This is either via an external (black) power adapter, or where internal AC-to-DC transformers are used, it is situated somewhere in the appliance and can be found where the casing feels hotter. Transformers are lossy and depending on their design and cost, operate at efficiencies of between 25% and 90%. (Calwell & Reeder, 2002: 4). An important niche environment where DC appliances are used is in the leisure

industry where the electrical supply is from 12V (car) batteries. However the range of products available while increasing, is limited (RoadPro, 2013) compared to the amount of off-the-shelf AC powered household appliances.

Advantages of DC voltage

If DC electricity is used as the sole means of electrical supply then there will be the advantage of the elimination of the ubiquitous AC transformer's in each appliance, which can be up to 25 per household (Calwell & Reeder, 2002, p.7) and when micro-generators are used, the need for an expensive inverter is eliminated. Their elimination reduces the amount of energy lost in multiple conversions and therefore for a given peak load requirement, smaller DC micro generators will be needed, and therefore the cost for the system will be smaller (M.C. Kinn, 2011, p.109). Or for the same outlay a larger DC micro-generation system can be installed thus increasing the energy supply. DC electrical applications have less parts than their AC equivalence, therefore their mean-time-to-failure is lower, and in operation DC motors, fans, compressors, etc. are much quieter (M.C. Kinn, 2011, pp.113-114). By eliminating transformers, and increasing their mean-time-to-failure, their life cycle carbon footprint should be smaller than that of an AC equivalent application. Another advantage of DC only appliances is, their physical size is smaller and therefore the amount of materials needed to manufacture them is less. Although all this is logical and claimed by manufacturers, to prove this academically further work is needed. One only has to look at the iterations of the mobile phone over the last thirty years to see how power electronics and battery size has miniaturised. One very important outcome of the technical transition to DC voltage will be to provide the best level of energy independence with security available.

Technical limitations at this time

The main technical limitation of using DC electricity is the operating voltage. Extra-low-voltage, which is that below 50 Volts (BSI, 2008 -2011) suffers from voltage drop issues, whereas low-voltage applications up to 400 V DC suffer from unique safety issues (M.C. Kinn, 2011 Chapter 5).

Methodology

For this research the starting reference is the existing technical components of a grid connected AC voltage system. Changing the electrical system from AC to DC or just making the decision to use DC instead of AC as a means to provide electricity to the 1.4 Billion people (G.E.A & IIASA, 2012: xv) who are not yet connected to the grid, has far reaching consequences beyond the actual technical changes to the electrical system itself. Each DC component will have to be designed and manufactured to a specific specification, installed by an accredited installer, and used in a safe manor. All this has to operate in a highly regulated environment.

There are many interactions between people and the technology throughout the life cycle of the electricity system, these interactions will be affected by the decision to use DC voltage. Therefore DC voltage not only changes the *technical system* but it will also have consequential effects on *people*; from policy makers, to manufactures/installers to end users, as well as on the *rules* and *regulations* that surround decision making, installation, maintenance and the end use. There is also the effect this will have on *societal goals*, like carbon footprint, energy independence

with security, fuel poverty, resilience of supply and sustainability, see section 2 of Summary for Policymakers, (G.E.A & IIASA, 2012, p.35.). Therefore the system in which the DC voltage is to be implemented has to be looked at in a wider context as a Socio-Technical system, where the importance of who is affected and how they are affected, together with the technical system, will all have to be taken into consideration.

The aim of this paper is to use socio-technical theory to identify the different regime networks and how they interact with each other. In section 2 we will look at socio-technical theory in general and in section 3 we will look at the different networks of people who will be affected by the changeover and some of the interactions between the networks will be presented. The conclusion and further work are in Section 4

Socio-technical systems theory

Introduction

Understanding how changes in coalmining affected the coalminers (Trist, 1951) was a seminal work in understanding Socio-technical transition theory, which has since been used to understand transitions from sails to steam in ships (F. W. Geels, 2002), from a high to a low carbon electricity system (Foxon, Hammond, & Pearson, 2010), changes in the Dutch electricity system (Verbong & Geels, 2007), and now for the transition from AC to DC voltage in the built environment.

The socio-technical theory used in this paper is based on the many academic papers put out by Professor Frank W. Geels and looks at the electrical system in the built environment through the eyes of his multi-level perspective (MLP) (F. W. Geels, 2002). In general our electrical system exists in the socio-technical model on three levels, the *landscape*, the *regimes* and the *niches* Fig 1. The landscape provides the influences that put pressure from ‘above’ on the actors who operate in the regime level and the niches are innovations that have identified existing, or who want to open new, ‘windows of opportunity’ to change aspects of the regime that will enable change to the landscape.

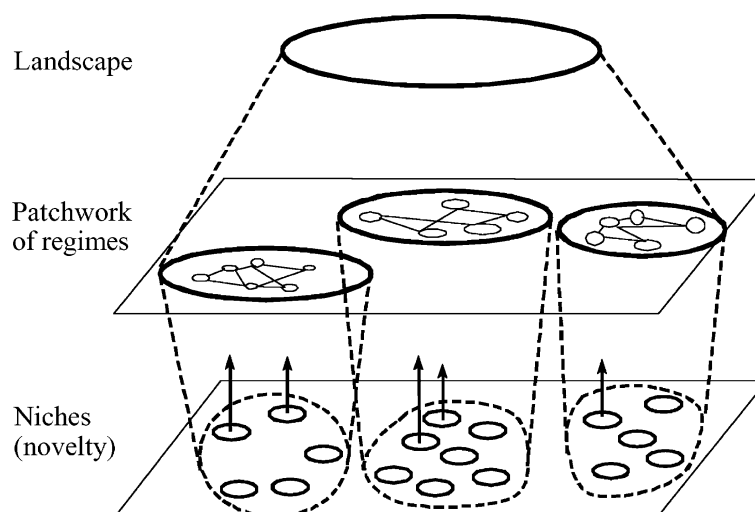


Fig 1 Multiple levels as a nested hierarchy.

The Socio-technical Landscape

The electricity market exists in a mature production and distribution system stabilised by many locked-in mechanisms, where continuity of supply is taken for granted by most consumers. However *continuity of energy supply* is in fact a landscape pressure and is dependent on landscape activities such as; a continuing availability of fossil fuels, supply chain resilience to sudden changes like natural disasters, terrorism or war and consumer ability to pay for the electricity without being in “fuel poverty”.

The different methods of producing electricity and the amount consumed, provides its own landscape pressures. The terminology in use is the lifecycle-carbon-footprint associated with consumption and its consequential effect on *climate change*. Therefore continuity of energy supply and climate change are two main landscape pressures placed on the producers and consumers of electricity. The solution required to alleviate these pressures is for the electrical system to provide energy security with independence in a sustainable way. This can be achieved with what is known as a decentralised, or as sometimes called a distributed energy generation system (Patwardhan et al., 2012, p.1187.)

The Socio-technical Regime Networks

The socio-technical regime comprises different networks, each of which has its unique set of actors (people) who operate within one or more networks, and who have many interactions with members of other networks who rely on their output to make decisions. All the actors in the regime networks work to keep the system dynamically stable. We have identified six regime networks associated with the use of electricity in the built environment. We start with the *technical system* which is passive, and continue with the *user* and *supplier* networks, which are usually very benign, but have a limited input into the decisions about using DC. Then the *research*, *standards* and *societal-groups* networks which are intricately involved in supplying the research and providing the written information needed by the *policy* network, who are the decision makers who will be legislating and regulating the new DC voltage system.

The Niche Innovations

This is the innovative change/s that is/are being initiated to the technical system to alleviate the pressure from the landscape. This research is employing the niche innovation that the supply and consumption of the electricity in the built environment should be in the form of DC voltage. For the regime actors to be willing and able to implement this niche innovation they must be convinced that the change will alleviate the existing landscape pressures. The process through which a niche innovation will go is explained by Geels and is illustrated in his Fig 1 (Frank W. Geels & Schot, 2007).

The actor networks in the socio-technical regime

Introduction

The electrical system is by definition technical; however there are many direct human interactions with the actual system, as well as those who are involved in all the decisions made for its safe implementation. We have therefore identified several different regime networks in the meso level of MLP model. Starting with the technical system, and those who are directly connected with it, and then working our way

through the standards and research networks until we will finally come to the decision makers. These different regime networks cannot be looked at in isolation, as there will be interactions between the different actors in a regime as well as between different regimes. These multiple connections form a web of interactions that can be quite complicated. In Fig 2 we have listed the different regime networks in the order of their ability to influence the decision to implement DC voltage.

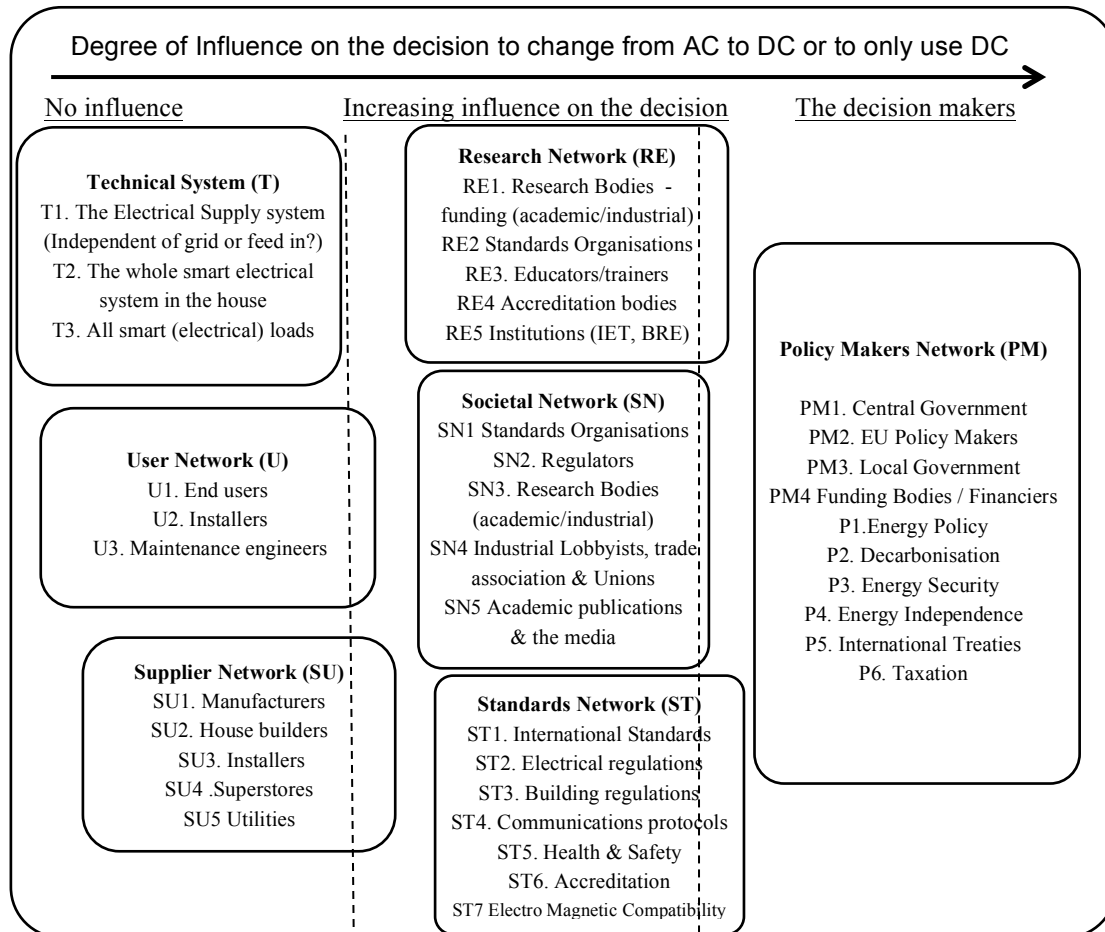


Fig. 2 The regime actors in the socio-technical electricity system

The technical system (T)

In general the AC electrical system in the built environment is a fully locked-in functional passive system which can be split up into three components, the electrical supply, the electrical mains system, and the loads. As a physical installation, the technical system will be wholly within the “no influence” category of our model.

(1) The electrical supply system

At this time the AC electrical supply coming into a home is via a 100A cable that connects to the multiplexer board via the (smart) meter. With a hybrid system there will still be an AC grid connection, which will be the backup system and a micro-generation system that will provide the DC supply. For the DC only system besides the micro-generators, inverter and voltage regulator, there will be a backup storage system. (The type of generators and backup system that could be used is beyond the scope of this paper)

(2) The electrical mains system

In an AC system there is 2.5mm² wiring for the power sockets and 1.5mm² wiring for the lighting system. All wiring starts at the multiplexer board and terminates at the power or light sockets. For extra low voltage DC electricity, a new set of larger cables of 4mm² and 6mm² will need to be installed (M.C. Kinn, 2011, para. 5.4.1). (The system voltage for DC electricity in the built environment is not yet defined and is beyond the scope of this paper)

The smartness of the DC system is not only in its' ability to do smart things like control lighting, open and close curtains or remotely control devices, (Aldrich & Harper, 2003), the control system will also be able to act like a smart grid whereby it will be monitoring the voltages and currents and making many autonomous decisions about how energy is used. The control system will consist of a CPU, a mobile phone interface (Liu et al., 2005), communications channels and embedded electronics in every place that an activity will be monitored. This will mean that all switches, and wall and light sockets, will all be replaced with those that have smart embedded electronics. In essence, this system will be a Home Area Network (DECC, 2012). It is envisioned that there will not be any need for a set of data cables as the control system will employ a power line communications protocol. (Moshe C. Kinn, 2011)

(3) The loads

Traditionally electrical loads operated on purely AC voltage, however today almost all of AC loads have electronics incorporated in them for control, monitoring or interface purposes, which are supplied with DC voltage via an internal AC-to-DC converter. In the DC environment there will be no AC loads, all motors, compressors etc. will be DC, with an embedded chip-set and software that will allow for interaction with the control system. At this time there are a few competing/complimentary smart-house electronic technologies each with its own set of protocols, (HD-PLC; HomePlug; HomePNA; KNX; Zigbee). From the electrical engineering point of view the traditional interface between the load and the power supply, the plug, will change from its traditional shape to one of much smaller size with two or three contacts depending if earthing is needed.

The technical transition from an AC electrical system to a DC system will see many changes to the components in the technical regime. All these changes will affect other regime actors, such that a web of regime network interfaces will take place. Understanding all the multifaceted interactions that presently exist in the socio-technical electrical system, is key to understanding; to what extent AC electricity is locked-in (Allen, Hammond, & McManus, 2008; Unruh, 2000, 2002), what transition pathways will exist to facilitate the transition from AC to DC (Patwardhan et al., 2012; Verbong & Geels, 2007), or in the case of those not yet connected, from the present lock-ins to the implementation of a DC system.

Users network (U)

The label "Users" is used very loosely, as besides the consumers, users will also include the electricians/technicians that install the system and the engineers that maintain it. Today's AC system is passive, and the maximum that is required is changing light bulbs and occasionally resetting the circuit breaker. However in the smart DC environment, depending on the system specification there may be a higher level of interaction between the users and the technical system for which training will

be needed. Traditional system designers and installers will need to be retrained to understand the new electronic environment and be recredited to maintain a high standard of workmanship. New skills that include computer control and communication networks that are not associated with traditional AC systems will be needed. All this will be provided by the research and standards networks.

Users are individuals and have very little influence on the decision making process with regard to the use of DC, but are affected by the decision to do so. However as an organised group they can raise awareness of things that affect them and place pressure on the decision makers, using the societal network discussed below. They therefore have been placed slightly into the increasing influence category.

The Supplier Network (SU)

The hardware and loads in the new smart DC environment will be radically different than those in the traditional passive AC environment and will have to conform to the constraints put on them from the standards, research and societal networks. Although at this time some DC hardware and loads do exist, much will have to be re-engineered or adapted for the full DC environment to come to fruition. For the provision of DC supplies, the whole supply chain will have to work together. In a sense, there is a chicken and egg scenario, property developers will only specify a DC system if it is available in the market to buy, while manufacturers will only make and retailers will only stock, products that sell. Therefore for DC to become a strong force in the built environment, a market mover or catalyst will be needed that could provide the demand that will drive the supply. The development of energy service companies is another strong way to further the proliferation of DC. The supplier network is usually constrained by the standards regime and the laws and regulations under which it must operate, as well as market influences. In a free market, policy makers need those in the supplier network who are able to be market makers/movers to take up their decision and implement DC. This gives them somewhat a limited influence, we have therefore placed them more into the increasing influence domain.

The Standards network (ST)

Electricity by its nature can be harmful to both humans and to other hardware connected to the network. Therefore in the built environment there exists, Statutes, regulations, internationally/nationally recognised Standards, protocols and recommendations, to maintain high standards of manufacture, installation, operation and health & safety. Therefore changing from AC to DC will require a change in the whole regulatory environment that encapsulates the use of electricity in the built environment, a change that will affect many of the other regime networks. To be able to redraft or amend the current documentation the technocrats responsible will need to be informed by the research network about all aspects of how DC will affect the way electricity is used. Through the production of Standards this network is one of the most influential networks in the entire socio-technical regime. These Standards are not only the body/basis of many policy decisions, but actors in this regime also operate within the policy regime, thus this network overlaps into the decision making domain.

A comprehensive list of statutory regulations and associated memoranda that exist for installations in the AC electrical environment can be found in Appendix 2 of BS 7671:2008 2011 (page 292). For installations in the DC environment many, if not all

of them will need some sort of additions and amendments. Other regulations that will need to be looked at are the building regulations, and retraining and accrediting installers.

For power line communications protocols in a smart DC environment, there are different international standards depending on the speed of data transfer, the modulation technique used, the frequency at which the system operates and the band width used, to name but a few. (Kinn, 2011b Section VI).

Some of the UK Statutes and regulations that will be effected by the change from AC to DC will include:

1. Requirements for electrical Installations IET Wiring Regulations BS 7671:2008 2011
2. Electrical Safety, Quality and Continuity regulations 2002 as amended.
3. Electricity at Work Regulations 1989 (SI 1989 No 635)
4. Electrical Equipment Safety Regulations 1994 (SI 1994 No 3260)
5. The Plug and Sockets etc. (safety) Regulations 1994 (SI 1994 No 1768) - made under the Consumer Safety Act 1978.
6. The electromagnetic Compatibility Regulations 2005 (SI 2005 No 281)

The Research Network (RE)

(1) Introduction

Technical input will be needed over the whole lifecycle of the electrical system. The research regime can be split into three streams; the first is the electrical system specification, the second is the re-engineered/ adapted AC system components, and the third is the correct and safe installation, maintenance and usage of the system. The process starts by research to characterise the existing AC system and the proposed DC system. Then to look at which changes will be needed in the whole socio-technical environment so that we can understand how DC can be implemented in a safe and sustainable manner. This is only the framework for the physical aspects, then there is the process to change standards, regulations, and working practices which involve technocrats doing research and forming working committees to draft new documentation.

(2) The electrical specification

Foremost what is needed is research to establish a new voltage and current rating for the DC environment. This has to be set such that the power ratings of the DC loads are optimised and system energy losses are minimised. Extra low voltage DC systems suffer from voltage drop and ultimately system failure, therefore such systems will need a specific control mechanism. In the build environment low voltage DC of between 300 to 400 volts do not usually suffer from voltage drops but they have their unique problems including the size of the electrical system components needed to deal with electrical arcing and earthing hazards.

(3) DC components and loads

In the all DC environment all loads will have to be converted to run on DC voltage. The work that those in the research regime will have to do will be the reengineering, redesigning, and testing of new prototype DC loads. They will also need to compare

and contrast energy consumption, carbon footprint, and life-cycle of comparable AC and DC gadgetry to prove or disprove if DC gadgetry can be more sustainable than AC equivalents. Their goal will be to make DC gadgetry operate with the same ease as AC equivalents but be designed so that their power consumption is optimised. This work will be invaluable in the process of DC development.

The actors in the research network will have multiple interactions with every other regime network. They will have to characterise and specify the technical aspects and see how they will affect the user and standards networks. From the point of view of installation, they must provide information and education to the policy, user and supplier networks, often via the societal network of peers, media, trade associations and educational institutions in their own network. They will have to secure public or private finance via actors in the policy network. They are therefore placed in the increasing influence category. However, as in many cases, what they produce will be decisions that the decision-makers rubber stamp, and as many of them will be technocrats operating in the policy regime, we have placed them overlapping into the decision makers category.

Societal networks (SN)

The proliferation of DC will bring profound changes to many people. There are many industrial, trade and professional associations, unions, and the media all of whom seek to defend their members or agendas in one way or another. They will have to be informed and consulted with, if their members have to change any working practices. Most of these network actors influence the decision makers by way of public pressure. We have therefore overlapped this network into the “decision makers” domain.

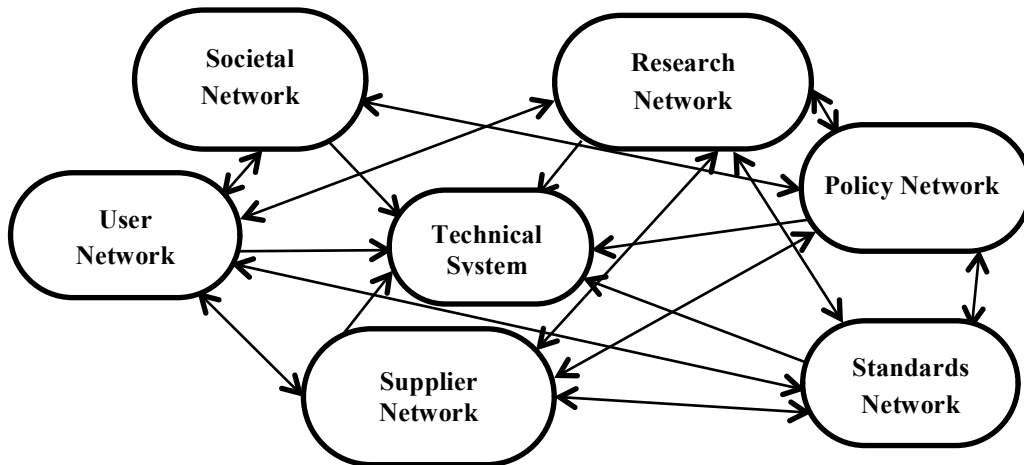


Fig 3. The web of interactions between the regime networks

The Policy Makers network (PM)

Those in this network have the power to make the decisions that govern the way we live and develop public policy to fulfil societal needs. They are therefore the ones with whom the decision to use DC voltage in the built environment lays. Decisions made whether statutory or regulatory, will be based on information received from many other regime networks. These decisions are written down in Acts of Parliament, regulations, policy documents, and standards. The ultimate arbiter as to the public

financing of research is the Chancellor of the Exchequer who sets the overall UK research budget, however the decision makers as to direct funding of a DC voltage project would be through the research network.

Discussion

Of the three components in the transition from AC to DC electricity that have been laid down by Foxon et al (2010, p.1205.), this paper has endeavoured to characterised the existing regimes in the electrical system, and has identified a niche innovation as the change from the use of AC to DC electricity. The third component, to specify the transition pathways, has been left for future work. The preceding analysis has revealed the complexity of the socio-technical system that surrounds the generation, distribution and use of electricity in the home. It illustrates well that technical solutions will not only be required to produce improved technical performance, but will also need to fit within or reshape a whole variety of regime networks. By illustrating the context of the electrical system in this way we can gain a rich understanding of the current situation.

What we have also found is that regime actors are not exclusively associated with specific networks, many actors have a have a role to play in different regimes. This duality of role should help bridge the gap between different networks, and towards breaking down barriers to the present locked-in system. It has been found that there are universal landscape pressures in the energy system. However, different policy regimes in different parts of the world may put more emphasis on some, which therefore produces different energy policy in different countries. This in turn will dictate that the transition pathway in one country may be different than that in another. It is therefore hoped that the analysis in this paper can be useful in helping to answer questions such as: What other types of niche innovations might fit easily into the current system? For particular niche innovations, what changes to the regime and/or landscape might be necessary for the innovation to take hold? In which international contexts might a particular innovation have the best chance of taking hold?

Conclusions and further work

This research has shown that characterising the electrical system in the built environment by using socio-technical systems theory, shows the complexity of both the social and technical aspects of the system and the consequent difficulties in making changes. It has also shown the web of different actor interactions (Fig 3) that are associated with changing from AC to DC, many of whom have no direct connection with the physical change, but are outside facilitators and some have their own agendas. These agendas coupled with a locked-in AC system will act as barriers to the change. It has also shown that some network actors can function in more than one regime network. This analysis also allows us to do further research that will look at possible transition pathways that will remove barriers and break-out from the AC system lock-in, to the development and proliferation of new DC systems.

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The Third Phase of The Lighting Profession: A New Approach

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Abstract

The lighting industry has entered a new stage of design, heralded as the 'third stage of the lighting profession', which is attempting to combat the lack of relationship between lighting design, human satisfaction/performance and well being, rather than only satisfying visual performance. A new approach is outline, which would enable designers to base their designs around codes and standards, but allow more flexible and creative ideas to be developed into physical installations, enabling a flexible and creative design approach. To understand the proposed philosophy the paper will define the 'third stage of the lighting profession', examine current lighting design practice, identify recent industry developments, identify design approaches to promote health, well-being and performance and concludes by evaluating the proposed approach in relation to the third stage of lighting design.

Keywords

Well-being, Lighting, Methodology, Naturalness, Triangulation.

Introduction

The industry has recently entered a new stage of lighting design, which is being heralded as the 'third stage of the lighting profession' (C. Cuttle, 2010). The third stage of the lighting profession is a concept originally expressed by Tulla (2008) and was subsequently adopted by Cuttle (2010). Cuttle explains that the objective of the first stage of lighting was to simply provide a uniform illuminance on a horizontal plane. This progressed to the second stage where the advancement of standard codes and guidance was key to assisting designers in achieving visual performance and comfort within a space. The 'third stage of the lighting profession' is an approach which is purposefully attempting to combat the lack of relationship between lighting design, human satisfaction and wellbeing, rather than simply satisfying the notion of visual performance (Lam, 2011).

The author considers this third stage as 'Lighting for Humanology', this new philosophy would encourage designers to purposefully design beyond codes and standards and attempt to develop internal lighting schemes that work with the occupant, providing a comfortable environment, aiding and assisting with health and wellbeing and operational performance. Humanology is a concept that originated in the early 20th century, which attempted to understand people's exact system of reasoning by which moods, traits, characteristic, talents, eccentricities, idiosyncrasies and natures which can be readily discovered and analysed (J. B. Adams, 1922).

This paper shall define what the 'third stage of the lighting profession' is and establish if the term 'Lighting for Humanology' is appropriate. It shall assess if such a change

in the industry is required in the first instance, by evaluating current lighting design practice and establish which particular design areas would need modification, in order to benefit occupants health, wellbeing and operational performance.

Third Stage of lighting Design

Importance of progress

Lighting designers have attempted to develop the standard method of providing a prescribed illuminance on the working plane by introducing other objective factors, i.e. visual comfort, etc., but these are all based on the premise that if we omit visual discomfort, then by definition we are visually comfortable in an environment (C. Cuttle, 2010, p. 82).

The work of Boyce (2006) states that the industry is at a crossroads, where it can either choose to maintain a current course and be content with using visual comfort as the defining factor of lighting design, equating to internal environments filled with mundane lighting systems. Alternatively, a more tortuous path can be pursued, enabling a greater understanding of the biological effects of light and its potential applications for humans in the future.

The search for the 'good' space logically lies in society's understanding and awareness of the systematic contribution that buildings can make to our lives (Barrett, 2008, p. 7), it is apparent that lighting forms a key element of an such environment; however the definition of a 'good' space has been elusive. This search though has been criticised by some who suggest that the lighting industry is simply creating the need to think past purely visual comfort, because the majority of solutions available and the vast number of studies undertaken is saturated (Tulla, 2008). This view is limited and any potential to develop a solution that aids and assists human health is a worthy exercise to undertake.

Concept

Cuttle (2010) suggests that the 'third stage of the lighting profession' is moving on from the initial objectives of the first two stages of the lighting profession. The first stage ensured that a uniform illuminance was achieved within a space. The second stage followed with the production of codes and standards to assist in achieving visual performance. The third stage according to Cuttle is to consider the spatial parameters of a space and its apparent brightness, rather than concentrating on illumination arriving on a working plane.

Cuttle's (2009) suggestion for the third stage of the lighting profession is to base future recommendations on the amount of illumination arriving at the eye from reflected surfaces using a method called 'Mean Surface Exitance'. This method measures the amount of illuminance arriving at the eye following its first reflection, which would put an emphasis on ensuring an adequate illumination is delivered within the entire space, not just on a working plane (C Cuttle, 2009). This would adhere to the work of Barrett & Barrett (2010, p. 219) who questions the philosophy of how good spaces look and can contribute to society in terms of optimum human functioning, as they believe that senses are the primary source of obtaining an holistic individual response to a space, with lighting being a key component.

Critical evaluation of lighting design practice

To establish if there is potential to develop internal lighting design solutions within indoor environments, knowledge of internal lighting design from a holistic level is essential.

Development of lighting design procedures

Internal lighting design and visual comfort have been comprehensively studied and are well understood; however, it is only recently that the industry has become aware of the need for health and wellbeing of occupants to be considered (Petty, 2010, p. 218).

The quality of lighting delivered within an internal space should always be appropriate to the task being undertaken (Van Bommel & Van Den Beld, 2004, p. 257). It was generally considered between 1920 and 1970 that the quality of light was dependant upon the amount of uniform illuminance delivered onto a working plane (Goodman, 2009, p. 234), where the slogan ‘more light, better sight’ in relation to tasks undertaken was common (Boyce, 2006, p. 284). In the same period, an interest grew in lighting and recommendations were being developed, this led to a narrowing down of the criteria required to satisfy a particular environment.

These criteria arrived in the form of codes and standards which worked on the premise of ensuring that 90% of illumination required by the notional maximum required to undertake a task of ‘critical detail’, which is most commonly known as the Weston-Beutell method (Jay, 2001, p. 87). The codes are frequently subjected to criticism (Begemann, Van Den Beld, & Tenner, 1996; Boubekri, 2004) in relation to their actual relevance within the internal environment; however, the illuminance levels currently used within the industry bear no resemblance to actual visual performance (C. Cuttle, 2010, p. 77).

A movement quickly followed which queried the amount of light individuals actually needed to undertake a certain task, where H.C. Weston conducted experiments to establish the connection between visual performance and task luminance at measured levels (C. Cuttle, 2010). The results of the H.C. Weston studies were adopted by the relevant codes and standards, such as the Society of Lighting ‘Code for Lighting’ (SLL, 2012), which to this day provides guidance in the form of average illuminance required to be delivered on a working plane, based on an anticipated task. Design guidance associated with health, wellbeing and performance is lacking, which is most evident within the latest British Standard for internal lighting, BS EN 12464-1, which does not provide any meaningful guidance to designers (BSI, 2011); which does not imply the growing necessity or urgency to consider health, wellbeing and performance in any detail when undertaking a lighting design.

Designing by numbers

The process of lighting design in practice can be broken down into two constituent elements, ‘functional’ lighting and ‘message’ lighting (Boyce, 2006, p. 285). Functional lighting is when illuminance is provided for a specific task, such as reading and writing, where a scientific quantitative approach would be adopted (Boyce, 2006, p. 284). In its simplest form, the design would consist of providing adequate illuminance on the working plane, sufficient uniformity throughout the space/task area and deliver an appropriate level of illumination on the walls and ceiling to assist with visual comfort (Entwistle, 2010, p. 37).

As every task is individual and every individual undertaking the task has a different visual range, then how does this relate back to the standard methods adopted by lighting designers? A particular effective example is related to the decrease in visual ability of an older individual, which is caused by the deterioration of the eyes lens (Van Bommel & Van Den Beld, 2004, p. 258). Therefore, if lighting quality should be high enough to guarantee visual performance for a particular task, how does an individual nearing retirement with a loss in visual acuity, compared to an individual just starting work adequately cope with the generic level illumination provided by a lighting installation within an internal space?

Message lighting is an alternative approach to functional lighting, which considers not only the space, but also the occupants. Message lighting is designed in context with the surroundings, integrating into the space and the architecture (Boyce, 2006, p. 285). This methodology appears to be moving away from quantitative design and stepping into the realms of qualitative design, which involves a common approach from both the architect and a creative lighting designer, where neither follow the exact requirements of stipulated codes, guidance and regulatory standards. There is generally however, no expectation within the construction industry that illumination engineering can make a positive contribution towards the creative process of building design (C. Cuttle, 2004, p. 201). This approach needs to change if lighting design procedures are to advance.

Role of the lighting designer

Professional lighting design was not recognised as a discipline in its own right until the 1960s (Petty, 2010, p. 223). Originally, due to the complexities and mathematical nature of lighting, a scientific approach was acceptable and the term ‘illuminating engineer’ was appropriate; however, due to the epistemological stance of the ‘lighting designer’ in this instance would be subjective, where the information they will use to produce the design is formed by them, taking into account their previous experience, perspectives and values (Runeson & Skitmore, 2008, p. 76) this now appears to have changed to ‘lighting designer’ where the emphasis is on the art of the lighting arrangement and the appearance of the space (Boyce, 2006, p. 284). A summary of design-based solutions is identified in Table 1.

This is somewhat problematic for a typical lighting designer as defined by the work of MacLeod (2010) who describes that traditional engineering education in the UK focuses on engineering science and not on the practice of engineering itself (R. S. Adams, Turns, & Atman, 2003). This is a similar analogy for functional lighting (engineering science) and ‘message’ lighting (engineering practice), where an engineering student learns the basics of lighting design (scientific and mathematical principles), but would learn the art (beauty) of lighting through practice and experience (Jay, 2001, p. 88).

A number of methods are available when designing a lighting scheme, including using a luminaire manufacturer, an electrical building services consulting engineer or a professional lighting designer. With reference back to the terms ‘illuminating engineer’ and ‘lighting designer’, the building services engineer (illuminating engineer) may understand the science and mathematical principles to design an appropriate lighting design, but may have limited artistic and spatial awareness, compared to a lighting designer.

Table 1: The bad, the indifferent and the good application of lighting design.

Adapted from (Boyce, 2006).

Condition	Scientific Approach	Epistemological Position	Primary Design Function	Outcome
Bad Lighting	None Applied	Objective	Concentration on one criterion. Considers energy efficient lighting is good lighting.	Visual discomfort probable. Poor environmental conditions.
Indifferent Lighting	Quantitative Approach	Objective	Application of codes and standards without thought. No experience applied.	Visual comfort achieved. Adequate environmental conditions, with a lack of stimulation.
Good Lighting	Quantitative/Qualitative	Subjective	Using codes and standards as a reference, but majority of design decisions are use previously gained experience and values.	Visual comfort achieved. Stimulating environment considering the context of the environment.

It is apparent that the role of a designer plays a significant part in the success of a lighting design, when considering the prospective installation from a subjective viewpoint.

Design considerations for health, wellbeing and operational performance

A change in the industry's perception of internal lightings systems began to gain pace at the beginning of the 21st Century and lighting engineers started to consider the control and manipulation of light quantity, spectrum, distribution, timing and duration of exposure for the benefit of occupants within a space (M. S. Rea, Figueiro, & Bullough, 2002).

In 1948 Hollwich hypothesised that light entering the eye is not only responsible for vision, but also various non-visual biological effects (Hubalek, Brink, & Schierz, 2010). However, it was not until the identification of a third photoreceptor within the retina of the eye in 2002, which was found to regulate human biological effects via the interpretation of light entering the eye (CIE, 2004) provided a catalyst for the investigations on its operation and what effect it had in relation to the health, wellbeing and operational performance of humans (Berman, 2008; Van Bommel & Van Den Beld, 2004).

Knowledge surrounding the daily effects of light exposure on humans is still in its infancy (M. Rea, 2006), however, as the awareness of the potential influences on humans has grown, so has the need for us to understand its implications (Kronqvist,

2010). A recent key discovery is the operation of the circadian system and its impact on human health, which is discussed later in the paper.

The topic of health, wellbeing and operational performance is vast with a large number of studies being undertaken with a view to understanding its effect on humans. Health, wellbeing and performance are generally dealt with separately, where visual performance/task performance falls into the category of visual elements, where as health and well being fall within the non-visual effects of lighting.

It is necessary to clarify that lighting for task performance, as previously discussed, is predominantly based around aspects of functional lighting, where a number of studies has identified the key factor is providing a sufficient illuminance on the working plane to undertake the task at hand. This may be inadequate and further research should concentrate on the non-visual effects of lighting, including psychological responses (mood and behaviour) and also physiological responses (health and wellbeing) (Goodman, 2009, p. 235).

Individual studies have been undertaken in relation to investigating individual components of lighting design. Key topic areas and papers are as follows:

- Variance of luminaire colour temperature to establish the effects of adjusting the lighting output from 3000k to 17000k (Govén, Laike, Pendse, & Sjöberg, 2007);
- Providing advanced user controls to allow individual occupants to choose the illuminance levels they prefer to work under (Logadóttir, Christoffersen, & Fotios, 2011);
- Increasing illuminance in the workplace to establish if there is any noticeable effects on occupants when subjected to illuminance levels in excess of regulatory standards (Wilhelm, Weckerle, Durst, Fahr, & Röck, 2011);
- Variance in direct and indirect lighting to establish if a preference exists amongst occupants within an internal environment (Fostervold & Nersveen, 2008); and
- Use of full spectrum lighting to investigate the impact of enhancing spatial brightness by mimicking natural daylight within an internal environment (Fotios & Cheal, 2011a, 2011b).

The studies noted above have provided mixed results, both positive and negative, but no single research study can confidently define a key elusive element that is to change the face of the lighting profession, if there is indeed one at all. Multiple methodologies have been used to study each area, although typically these studies have only concentrated on one element at a time. It is also important to note that a large proportion of studies undertaken have been carried out in laboratory conditions. Although this allows the specific aspect of lighting to be studied in detail, it does not help to establish a relationship between what an individual actually experiences and the various stimuli that surround them (Barrett & Barrett, 2010). This is key as the participants within a controlled laboratory environment are more motivated to succeed in the tasks presented to them and are subjected to the conditions for only a short period of time. Participants' visual capabilities will be the primary factor; this is in stark contrast to a daily work environment, in which they may be subjected to the

same lighting for a number of years. In this situation their task performance is more likely to be determined by psychology rather than physiology (Boyce, 2006, p. 287).

Daylight

As we have evolved and have abandoned our outdoor environment, limiting our exposure to the natural elements, including daylight, questions have been raised in regards to the impact on modern day society (M. Rea, Montagna, Chiarini, & Piperno, 2007).

A recurrent theme within the literature base relates to the potential benefits provided by natural daylight. Numerous studies have been undertaken attempting to establish links between the internal environment and the potential psychological and physiological benefits (Wang & Boubekri, 2011, p. 55) offered by natural daylight across different types of buildings and environments (Vine, Lee, Clear, DiBartolomeo, & Selkowitz, 1998).

It is quite ironic that we are now consider daylight to be an important factor within an internal environment, when this source was the primary method of illuminating an internal space during the early 20th Century, supplemented with artificial lighting (Edwards & Torcellini, 2002). Thus, the philosophy of providing constant ambient artificial lighting has gone full circle and the application for natural daylight within an office environment is preferred (Wang & Boubekri, 2011, p. 56) and encouraged by design guidance and regulatory standards.

Numerous studies have been undertaken to evaluate the effect of simulating natural daylight using full spectrum lamps, which operate within the blue (460-480nm) area of the visible light spectrum (Moore-Ede, Richardson, & Chacko, 2011; Pauley, 2004). These studies have provided positive results when compared to standard artificial lighting. The second aspect of the connection with the natural world has been tested with respect to the physical view that occupants have from sitting adjacent to a window (Boyce, 2003, p. 68; Heerwagen, 2000). Multiple hypotheses have been made in an attempt to establish why natural daylight might improve performance, health and wellbeing, however, there have been no conclusive studies linking daylight to such outcomes (Figueiro et al., 2010, p. 201).

Natural daylight illuminance is far in excess of internal illumination levels. A study on daylight illuminance (Vine et al., 1998) recorded lux levels between 782lux – 2146lux during a working day, which indicated that the occupants preferred or tolerated the increased illuminance, compared to artificial lighting. This is also confirmed by the work of Nabil & Mardaljevic (2005, p. 48) where they suggest that an increased illuminance is tolerated providing that the it does not cause discomfort, i.e. glare. It also been proven that a variance in daylight illuminance is desirable, provides a positive effect on occupants of office environments (Vallenduuk, 1999) and can change the mood of occupants (Boyce, 2006, p. 290), whilst promoting the natural circadian rhythm (de Kort & Smolders, 2010).

Natural daylight is key to the third receptor within the eye, which is responsible for biological input, which relies on light entering the eye and not delivered onto the working plane. This would suggest that spatial distribution of light within a space is key in delivering the correct type and quantity of light (Van Bommel & Van Den Beld, 2004). Current lighting standards provide guidance that equates to a constant sterile illuminance and colour temperature delivered within a space (Wang &

Boubekri, 2011, p. 56), which is generally applied within practice. However, natural light provides a variance over the space, which constantly evolves as a result of weather conditions and the position of the sun.

Dynamic Lighting

Dynamic internal lighting solutions provide varying illuminance within a space that does not have an adequate influx of natural daylight. A key paper in relation to dynamic lighting by Yaw de Kort and K Smolders (2010), which investigated the effects of introducing dynamic lighting into a workplace. The study adjusted both the illuminance (Lux) and colour temperature (K) of the lighting in line with the requirements of the non-visual circadian system and participant's response via a multitude of justified testing scales/methodologies. The adjustment to the lighting installation ranged from 500lux (3000K) to 700lux (5000K), the static scenario provided a constant 500lux at 3000K. It showed no significant differences between static and dynamic lighting when considering the need for recovery, vitality, alertness, headache and eyestrain, mental health, sleep quality and subjective performance; the occupants did however, prefer the dynamic lighting.

Naturalness

Barrett & Barrett (2010, p. 224) suggest that as we have evolved within a natural environment, it does not seem unreasonable to consider that humans have a deep rooted preference for 'naturalness'. A study by Butler and Biner (1989) identified that windows, allowing natural daylight into an office environment, are an important factor for occupants and provides sensations of pleasantness and warmth, even within an air-conditioned office.

This 'naturalness' should take into account the dynamic nature of illuminance and colour temperature, to promote natural circadian rhythms, but it should also enable the user to control their own environmental conditions as they wish. This individualisation would have been a natural state in the past, where no individual would have been subjected to an environment, in which they did not have control over, inline with their personal preference.

Taking into account the outdoor origins of humans, it could be suggested that naturalness, including natural daylight is key to developing a space in which occupants feel comfortable and would lead to improved health and wellbeing. It is therefore reasonable to suggest that a relationship exists between naturalness, human nature and humanology. The philosophy of humanology believes that humanology applies in everyday life, through a systematic and logical method of reasoning; this brings to the forefront, the individualistic and natural human preferences (J. B. Adams, 1922). Hence, its importance when considering the advancement of internal lighting design practice, with an emphasis on natural external environments.

The work of Korzybski (Korzybski, 1921) states that 'humanity must know the natural laws for humans, otherwise humans will not create the conditions and the customs that regulate human activities which will make it possible for them to have the most favorable circumstances for the fullest human development in life; which means the release of the maximum natural-creative energy and expression in mental, moral, material and spiritual and all the other great fields of human activities, resulting in happiness in life and in work "collectively and individually" because the

conditions of the earning of a livelihood influence and shape all our mental processes and activities, the quality and the form of human inter-relationship'. It begs the question, how can we release this so-called 'natural-creative' energy within an alien internal environment?

It is also apparent that those who considered that engineering, which equated to the total-sum of human knowledge gathered through the ages by the application of mathematics, would embody the theory and practice of science and art. This theory and practice would unite engineering branches by a common aim, the understanding and welfare of mankind (Korzybski, 1921). From what we now know about lighting practice, it is clear that this philosophy has failed and the art has been lost in translation.

Conclusions

Taking into account the arguments put forward, it is apparent that Cuttle's idea alone is not justified in being termed the 'third stage of the lighting profession'. The incorporation and amalgamation of the most current knowledge on health, wellbeing and performance should sit hand in hand with his concept, thereby providing a more holistic approach, applying the concept of 'Naturalness'.

Due to the infancy of the knowledge surrounding lighting for humans, it would be reasonable to suggest that we are someway off applying such solutions within an office environment, but it is time for experimental studies to be undertaken which investigate such a holistic philosophy, within a real working environment (de Kort & Smolders, 2010, p. 357). As Cuttle (2004, p. 213) suggests, 'The real legacy of today's lighting designers is to develop holistic approaches to envisaging 'a preconceived appearance to the interior' coupled with illumination engineering procedures for achieving it. This process would require input from a number of different design team members to arrive at a successful holistic design; this may be where the trouble begins.

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Development of A Prototype Electronic Document And Record Management System (Edrms) For Small and Medium Building Firms In Nigeria

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Abstract

The amount of documents and records produced within the information process during the course of a construction project is overwhelming. Consequently, proper management of these documents and records is of key importance regarding efficiency and quality management in construction industry. This paper is part of on-going PhD research and is concerned with the status of records management practice among small and medium building firms in Nigeria. It examines the challenges in the implementation of the record management practice by the building firms; which include among others, no alternative, affordable, efficient and user-friendly automated electronic document and record management (EDRM) system the building firms can adopt for use. The aim of the study is therefore to develop a prototype EDRM system for managing records in small and medium building firms with a view to enhancing project records management practices. The research adopted a combination of methodologies using both quantitative and qualitative techniques together with a literature review to identify challenges that hinders the efficient implementation of record management practice. Structured questionnaires administered were used to identify practice in records management through which the requirements for EDRMS was captured. To address these problems, a computer prototype (EDRMS) system, that is, affordable, efficient and user-friendly was develop to enhance the record management practice for these building firms. For effective use of the developed prototype EDRM system, the developed system was tested, validated; and a user guide provided for effective use of the system.

Keywords

Computer Prototype, Electronic Document and Record Management System, Record Management, Small and Medium Building Firms, Nigeria

1 Introduction

Although construction may intuitively be perceived as an industry concerned primarily with labour and material intensive processes, construction work is highly dependent on information and communication. The material process can only function in integration with an information process, which gives birth to design information describing *what* to build, and management information describing *how* to build it (Björk, 1999). The amount of documents and records produced within the information process during the course of a construction project is overwhelming. Consequently,

proper management of these documents and records is of key importance regarding efficiency and quality management in construction industry.

In spite of its importance, Thurston et al (1996) discovered a pattern of inadequate records management systems and argue that the situation is endemic. They observed that poor records systems have serious consequences for both government and citizens and affect governments' ability to manage resources effectively and to comply with international conventions. The knowledge contained within the construction-based records must be captured into the organizations or project memory if it is to be shared amongst the wider team (Beastall, 1998).

Some of the problems associated with the record management practice in the building construction firms, particularly in Nigeria, are the use of electronic data management facilities, such as electronic document and record management systems (EDRMS). Though there exist several of these facilities in the market, developed by companies, such as IBM, Laserfiche, Oracle, Microsoft-Share Point, WatchDox, etc. (Capterra, 2012). Most of the building firms in Nigeria are not aware of these applications, while some avoid using them because of high cost in obtaining it, wider technical skills needed to operate them and high cost of training personnel that can use the applications.

The aim of this research paper was therefore to develop a prototype computer EDMRS for managing records in small and medium building firms in Nigeria, with a view to enhancing project records management practices. The objective was therefore to identify the challenges associated with the traditional form of project records management, and how they influence management practices in small and medium building construction firms in Nigeria.

2 Literature Review

2.1 Perspective on Document and Record

‘Document’ and ‘record’ are terms that are frequently used interchangeably. An understanding of these terms is essential to facilitate the capture of records that are judicial evidence of organisations. The International Records Management Trust (IRMT) defines a ‘document’ as a unit of recorded information, while for the International Standard Organisation (ISO, 2001), is defined as recorded information or object, which can be treated as a unit. The similarity of these definitions that embrace documents and records supports smooth administrative and business operations.

2.1.1 Building Construction Project Records

According to Wildman (1990), the extent of record keeping required for a particular construction job will depend on the type of contract. However, some record keeping would be required in any case because it is: *Required by law; required by the terms of the contract; needed to control the on-going work; needed as data for estimating future work; and needed for preserving the contractor's rights under the contract.* Perhaps the best case that can be made is that, if the contractor wishes to remain profitable he must maintain control of his on-going work, and control of on-going work requires on-going records. Studies have however, shown that most of these records are poorly kept by supervisors (Summerville et al, 2004).

2.1.2 Recordkeeping, Record Keepers and Recordkeeping System

Based on the ISO 15489 (2001), and discussion by McKemmish et al (2005), the writer is able to conclude that the term 'recordkeeping' should be understood as referring to the creation and maintenance of complete, accurate and reliable evidence of business transactions in the form of recorded information. The above writers suggest that the record keepers must fully appreciate their job and responsibilities in recordkeeping functions and activities aimed at protecting the integrity and authenticity of records as evidence of accountability in the electronic environment. A "recordkeeping system" is a manual or automated system that collects, organizes, and categorizes records, facilitating their preservation, retrieval, use, and disposition. A recordkeeping system has four components: These include records, people, processes and tools that will capture, organise, store, track and retrieve the records.

2.1.3 Records Management Standard

ISO 15489 was published in 2001 and the first ever-international standard on records management. The Standard outlines the elements that are required for good records management – appropriate policy, assigned responsibility, understanding of the environment and records management principles, design and implementation of records system, use of processes to support records systems, monitoring and training. At the core of the standard is a process for design and implementation of the record system (Dan, 2002).

Consequently, many organisations tend to ignore the evidence that organisations without records management programmes are at risk. Hare and McLeod (1997) reported that, for organisations without records management programmes, 40 per cent of those that suffer a disaster go out of business within a year; 43 per cent never reopen; and 29 per cent cease business within two years. When a records management system works well, the information contained in records can be readily retrieved. The disposal of unneeded records and the retention of valuable information can be managed effectively, and space, facilities, and resources can be used efficiently and economically.

2.1.4 Benefits of EDRMS

Streamlining business processes and increasing efficiency are fundamental concerns for any organisation, regardless of size or sector. In today's increasingly-strict regulatory environment, compliantly managing documents and records of all types, whether paper, electronic, audio, video or email, takes significant time and money that could better be spent achieving mission-critical objectives. By implementing document and records management software, business owners can realize many benefits that noticeably improve organizational efficiency. EDRMS can help organization succeed by *Saving money; Saving time; Increasing efficiency; Increasing productivity; Increasing inter-departmental and inter-organizational communication and collaboration, Generating revenue; and Enabling automation.*

A study report by Smarter (2007) showed a typical worker would take 12 minutes to process a single document. Nine of these 12 minutes are spent searching for, retrieving and refiling the document—meaning that only three minutes are spent actually using the information they have found. PriceWaterhouseCoopers study reports that the average worker spends 40% of their time managing non-essential documents, while the IDC estimates that employees spend 20% of their day looking

for information in hardcopy documents and that, 50% of the time, they can't find what they need. Laserfiche estimates a 20% timesaving based on filing and retrieval efficiencies, eliminating misfiling and workflow efficiencies. Increased efficiency, as well as greater staff productivity, can save up to 6,000 hours annually, or 2.4 full-time staff positions.

3 Research Methodology

This paper was part of PhD research thesis entitled "Development of a Prototype Electronic Document and Record Management System (EDRMS) for Small and Medium Building Construction Firms". The PhD research employed a combination of both qualitative and quantitative approaches. It begins by reviewing relevant literature from journal, textbook, government publications, conference papers and research papers to capture an understanding of record management practice. Part of the data collected from the structured questionnaire was used to determine the EDRMS requirements and the challenges involved in the implementation of record management practice by the small and medium building firms in Nigeria. The aim is to gain a clearer understanding on the key concepts in order to pave the way for the development of the computer prototype EDRM system.

A case study approach was employed in this study. Small and medium building construction firms contracting at Ahmadu Bello University, Zaria, Nigeria were used as the unit of analysis for the research. This approach was chosen because is an ideal methodology when a holistic, in-depth investigation is needed in a study of this nature. Samples of 113 small and medium building construction firms having construction activities with the University were surveyed. The instrument for the research requested the respondent to provide some biographical details. The questionnaire used was divided into two sections. The first section captured the requirements of EDRMS for these firms through examining the current trends in document and recordkeeping management standard practice by the firms, and the second identified the challenges the firms faced in traditional record management practice and the electronic system they used to supplement it.

4 Findings And Discussion

One hundred and thirteen questionnaires were administered to the small and medium building firms with the questionnaires being completed by their representatives. Follow-up efforts were made and in the process eighty-two completed questionnaires were received and the response rate to the questionnaire was 72.57%. This is judged to be a high rate of response which can be attributed to the follow-up efforts. A Descriptive statistics of data analysis using Statistical Package for the Social Sciences (SPSS VS 20) was used to analyse the returned questionnaires.

4.1. Size of the Building Construction Firms Surveyed

The result from the study shows that 42 firms have 0 – 9 employees (Micro), 32 firms have 10 – 99 employees (Small), while 8 firms have employees ranging from 100 – 299 (Medium). Thus, all the firms surveyed for the study fall under small and medium enterprises (SMEs) category.

4.2 Requirement for EDRMS for Small and Medium Building Construction Firms

In order to ascertain the requirement for the proposed computer prototype EDRMS, the study examined the current trends in documents and record keeping management standard being practiced by the surveyed firms, and the standard requirements set-up by ISO 15489 was adopted as a guide.

The result shows only 22 (26.8%) respondents are adopting a particular standard in managing records, while the remaining 60 (73.2%) respondents admitted they do not use any standard in managing their records. Out of this only 2 (2.4%) firms adopt ISO 15489 standard in managing their project records, while none of the firms are using standard established by Australian Government, AS 4390. Respondents using their own standard in managing records account to 20 (24.4%), while 60 (73.2%) admitted for not using any standard in managing records in their firms. The lack of proper standard methods in managing records could therefore affect the smooth running of these firms.

With respect to maintaining records, the result shows that all respondents (100%) reported that they maintained a collection of project records relating to the organisation's building construction activities. This was determined to be an indication that all the surveyed firms attached a degree of the importance to maintaining project records to enable them to carry out their business activities.

The result also shows it appears that the staff assigned to manage the firm's records are unlikely to have received appropriate professional training in records management. The inconsistency in the data obtained indicates that in some firms, more than one person is given the responsibility to take charge of their records. This data also implies that there is no strong correlation between post designated and qualification of personnel employed to handle the firm's records. Again, it infers that firms are not clear about what constitute records management. The general perception they have is that any personnel can handle records. This is confirmed when 59.8 per cent of the firms answered that personnel handling their records are without appropriate qualification.

The result indicates that more than half of the respondents (57.3%) reported that the firms records are not stored in a central location, they were scattered. None have records in a single central store, this indicate that most firms surveyed are ignorant of one of the major benefits of a records management system, namely removing records from relatively expensive to relatively cheap accommodation. The expected correlation between the persons responsible for records and their locations was not evident from the responses to this findings. Secondly it shows that respondents are unable to rationalise the importance of setting up a central location (i.e. a records centre) to accommodate their inactive records on the grounds of costs of records centre storage against office storage.

4.3 Challenges of Traditional Records Management in Small and Medium Building Firms

The result shows that all respondents (100%) reported facing some challenges in using traditional (paper) form of record management. This indicates that the surveyed firms have some degree of the problems pertaining to maintaining records, and thus, affecting the general performance of these firms.

Figure 4.1 shows the most frequent challenges facing the surveyed building construction firms is the large storage space required to manage paper records. This shows that the volume of records that can be stored using the traditional record management system (TRMS) is a serious challenge, because as the volume of records increase, so also does the physical space required to store them. Time consuming for searching and filing records scored 52% each from the respondents point of view. Almost 50% of the respondents have security challenges in managing their records. This is an indication that there is a risk of unauthorised personnel gaining access to the organisation's records. Records loss due to natural disaster, like, fire outbreak scored 44%. TRMS is slow and expensive (32%); difficulty in locating records is 30%. Limited user access, where multiple users at different work station cannot access the same data simultaneously ranked 29%. The least challenge reported by the respondents is where records are misfiled, this scored only 4%.

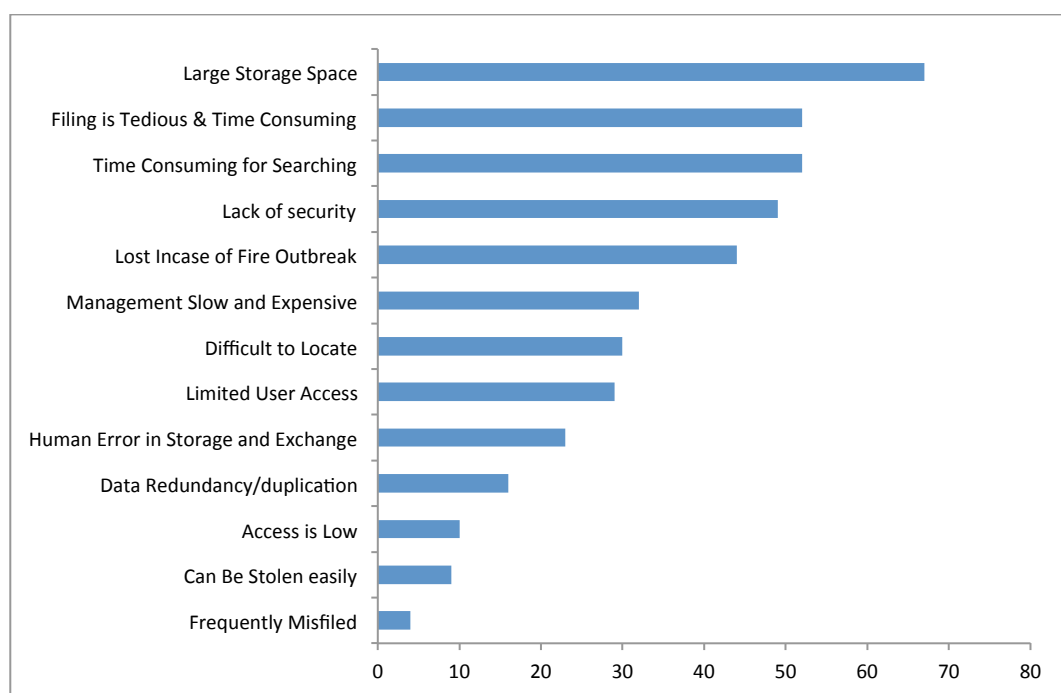


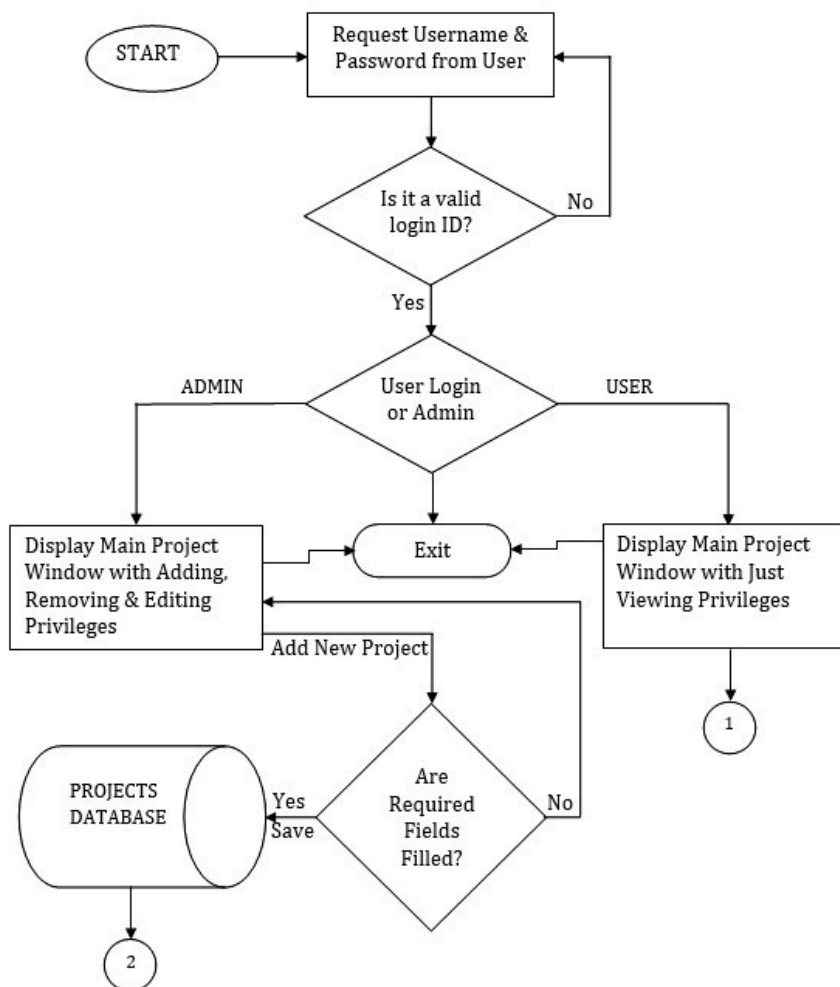
Fig. 4.1 Summary of challenges in traditional record management system

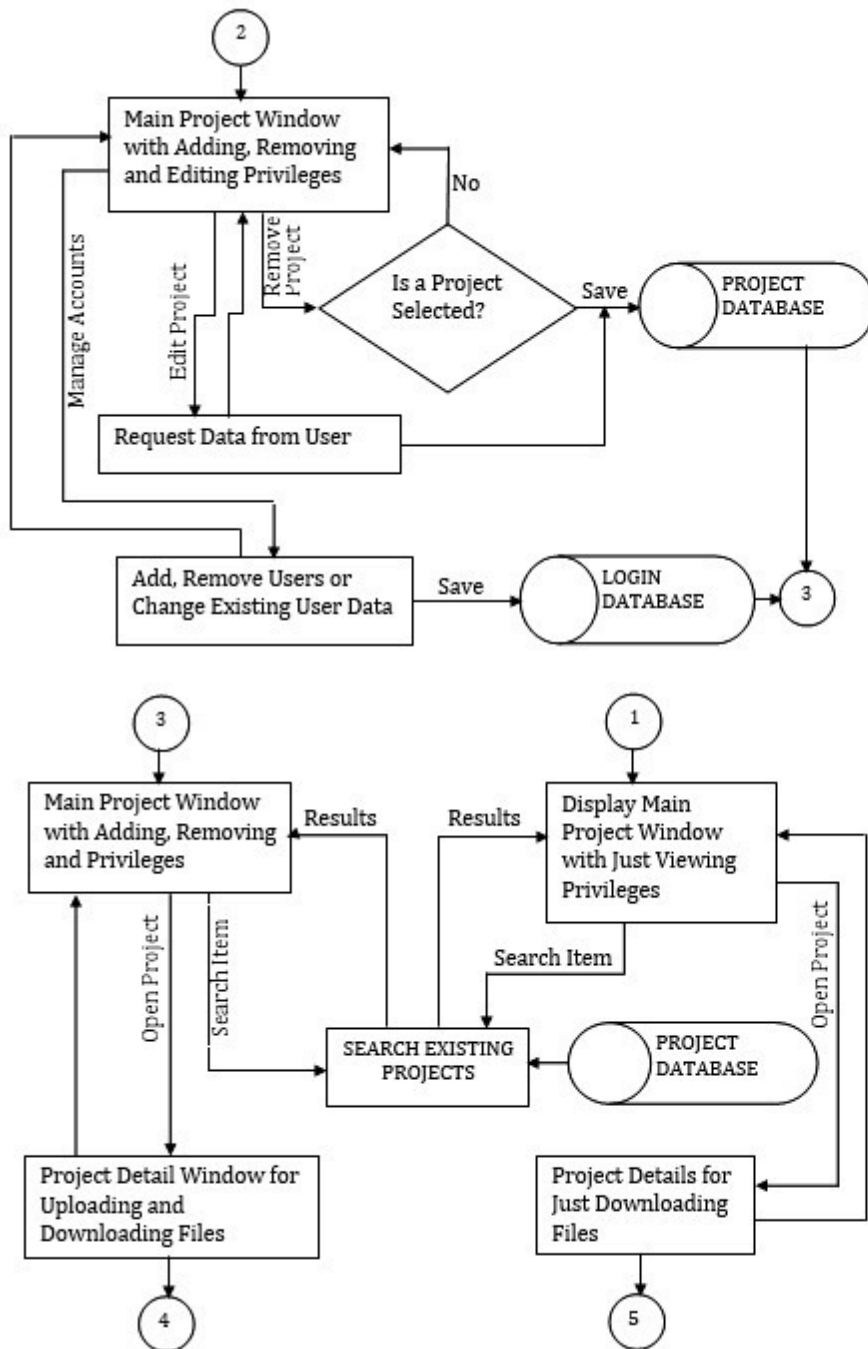
4.4 Development of the Prototype EDRM System

To develop the prototype EDRMS, firstly a conceptual framework was developed. The findings from this study were used to develop the conceptual framework for the proposed EDRM system as shown in Figure 4.2. The framework captured the requirements for the EDRM system and addressed the various challenges the firms face in using TRMS such storage space, searching, retrieval, information sharing and security of the records.

The security arrangement was created into two sections. The first section is for the administrator, who would be responsible in managing the firm's records. This is to comply with one of the ISO requirement, that for proper record management, there should be a trained personnel assigned to be in charge of organisation's record management. The second section was provided for authorised users permitted by the

organisation to have access to the stored records in the database. Both administrator and users are required to have a username and password before getting access to the database records.





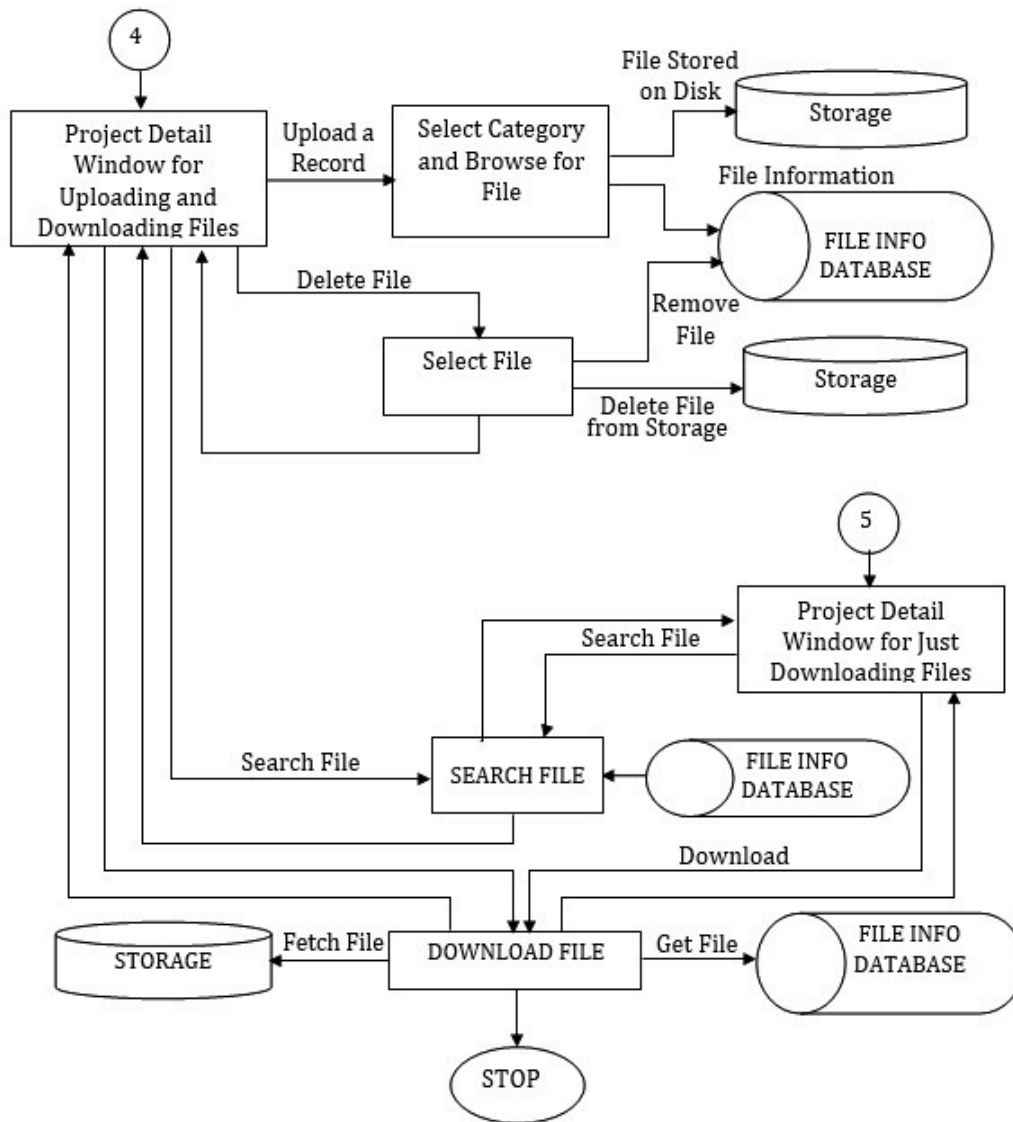


Fig. 4.2 Conceptual framework of the EDRM system

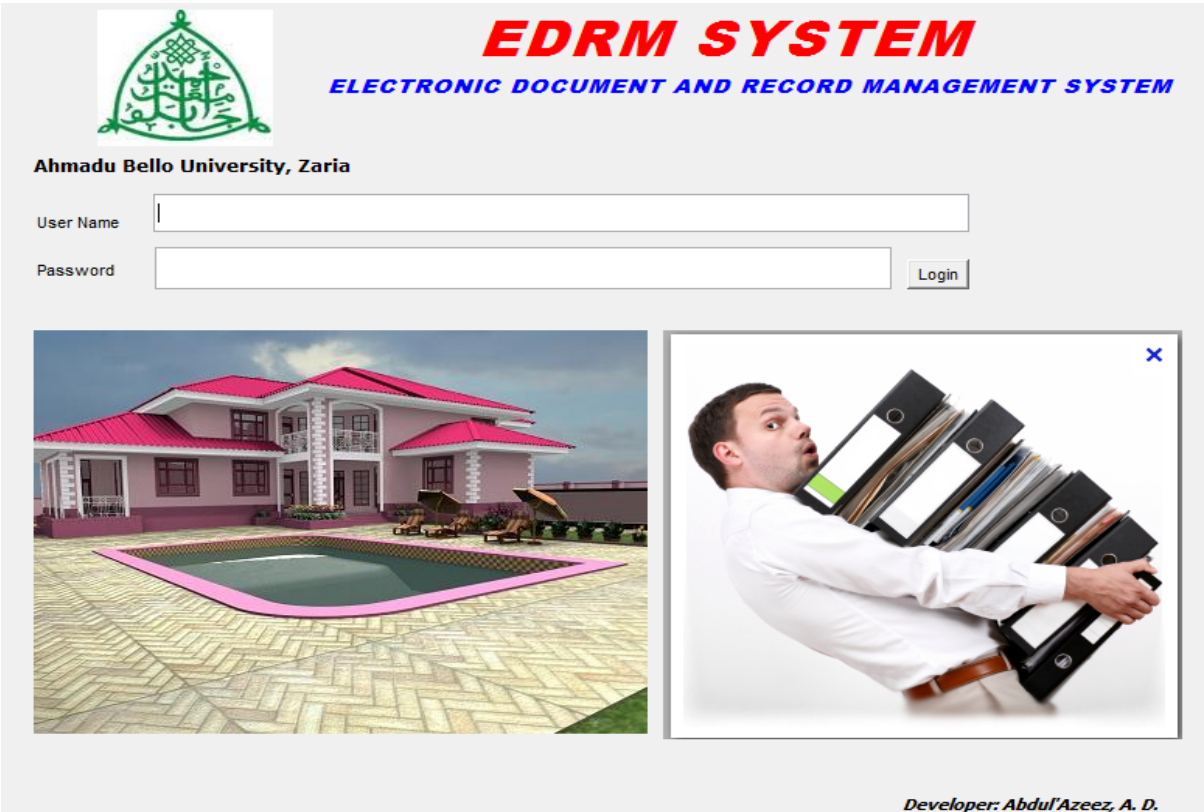
The *Server* that was used in this study is MySQL relational database management system (RDMS) from Oracle Software Inc., this server is adaptable to most of the operating systems used in the building construction firms in Nigeria. The reasons for using database are trivial; they are simply to provide the capability of being able to store huge amount of data efficiently, allowing for easy retrieval. It also provides manipulation of the stored data. It also provides a centralized control of the data. Java programming language was chosen in developing this prototype EDRM system, not only for its platform independence but also for its quick and easy ability to pick up, develop an application and deploy without much fuss. This is particularly when the de facto development environment; Netbeans integrated development environment (IDE) is used.

The developed EDRM system requires as a minimum, the following hardware specification for optimum performance. HDD: 40GB, RAM: 1GB, Processor: Pentium 4.2 GHz, Operating system: Windows Server 2003 Release 2. Database engine: MySQL 5.5 version. The minimum requirements for Workstation

requirements would be; CPU: Pentium III 1 GHz processor (or faster); Memory: 256 MB RAM; Operating system: Windows XP Professional; Web browser: Internet Explorer 6.0.

The system has been developed to be a user friendly; thereby a user with basic IT skills can operate the system. The functionality of the system among others is to, create; save; share; update; search and retrieve records and with maximum security of these records built into the system.

For first runs, a homepage window shown in Figure 4.3 would appear on the screen requesting for username and password. This would be the first stage that will allow the use of the developed EDRM system.



EDRM SYSTEM
ELECTRONIC DOCUMENT AND RECORD MANAGEMENT SYSTEM

Ahmadu Bello University, Zaria

User Name

Password

Developer: Abdul'Azeez, A. D.

Figure 4.3: Snapshot for Administrator Login into the Prototype EDRM System

5 Conclusion and Further Research

Given the bulk of information associated with construction projects, formal organisation of the information is essential so as to avoid chaos. With the events of microcomputer database managers, it is possible to develop formal computerized database for organisations to manage records. Equivalent organisation of information for manual manipulation is possible but tedious. Computer based information systems would therefore have a significant advantage to play in rapid retrieval of information for immediate use and in most instances lower overall costs of running the business.

The prototype EDRM system developed in this study would go along way in addressing most challenging issues in record management practice being experienced by small and medium building firms in Nigeria. It is therefore recommended for further research, that the developed EDRM system in this paper could be used to provide a guide towards developing a more comprehensive computer prototype electronic document and record management system (EDRMS) that will ensure effective and efficient record management practice for all categories of building firms in Nigeria.

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Developing an Approach to Enhance Information Reliability in Planning Asset Management Operations for Facility Managers

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Abstract

Planning management operations of asset is a complex process involving multi-participants that spans several years. Its success relies on accurate and precise information in making right decisions. Decisions on adopting the right asset management strategy or policy rely on accurate information. To achieve proper information reliability, it is important to ensure data is adequately optimised. This reduces redundancy when planning asset management operations of complex systems and mitigates the challenges of resource management. The intended outcome of this research is to introduce a new philosophy in managing planned maintenance operations of assets by facility managers that will be cost effective, reduce risk, and improve performance of managed assets through the use of enabling technologies and a shared system approach. This ensures information reliability in a multi-participants setup and aid in decision making during asset life-cycle management. A model for its implementation is outlined. A qualitative research methodology using case-study method and secondary data analysis has being adopted for this study.

Keywords

Assets Management; Data Management; Facility Management; Information Reliability; Planned Maintenance Operations; Qualitative Research

The Facility Maintenance Management Operations

Built infrastructure are significant assets and according to Wauters (2005) and Rondeau et al. (2006), an organization's second largest expense is the property (comprising of fixed and moveable assets) costs which are relatively fixed component of the budget and also the largest item on the balance sheet. They account for as much as 15% of turnover and 25% of all fixed asset (Alexander, 2003). As a consequence, it is important that they are managed to add value to the organization. This forms part of the function of facility management and in this regard, the facility manager would typically be concerned with issues such as physical, functional and financial performance (Wauters, 2005). Facility managers are tasked to manage such assets in the most efficient manner over its entire service life where the basics are: (a) to provide the required functionality, (b) to optimize economic benefit throughout the asset service life by reducing total life-cycle costs, and (c) to improve their physical condition and long-term performance of the facility and environment (Kyle et al., 2002). Thus the performance of buildings relies on the proper maintenance operation and management of assets that requires an integration of knowledge, technologies,

processes, and people (Lai and Yik, 2007; Lewis et al., 2010). This embodies the principles of strategic asset management.

As facility management practice become juxtaposed within the core operation framework of client organisations servicing the operational phase, the range of services covered within the remit by facilities managers inadvertently become more complex (The Facilities Society, 2012). This phase (operation phase) of facilities is very dynamic and comprises iterative phases and intermediate changes involving many actors with shifting agendas, roles and responsibilities (Lewis et al., 2010; Sebastian, 2011). It is regarded as the longest phase of the building life cycle (Swallow and Chanter, 2007) and presents a significant cost to organisations (Clayton et al., 1999; Lewis et al., 2010; Swallow and Chanter, 2007; Wood, 2005). It forms the bulk of activities carried out by the facility managers (BIFM, 2009; Yik et al., 2010) which involves daily and scheduled management activities, such as maintenance, remodelling, replacement of components and daily caretaking activities i.e. cleaning and catering (BIFM, 2009).

Two factors affects the performance outcome of facility management in the operation phase; 1. the reactive component and 2. the planned component (Figure 2.1). The reactive component of the operation phase deals with issues that occur on a day-to-day basis that may cause acute disruption to services provided. This may lead to loss in revenue for that period and if not mitigated immediately may lead to further disruption of the entire business. The planned component consists of detailed and scheduled operations that: (1) identifies and mitigate problems which may occur in the future, or (2) makes required changes or reconfiguration to systems. It takes into consideration factors the influences the operations of the organization both externally and internally. This sort of planning may vary from a few days to many years and requires the right information to make the right decisions.

Within this context, maintenance management has a significant role in keeping system operating as designed or at a level that meets the operational goals of the facility (Lewis et al., 2010). This makes significant adjustment to the structure and configuration of the facility and generates significant amount of data which are not properly recorded (Akcamete, 2011). Achieving significant success in this activity involves a coherent and comprehensive asset maintenance management strategy (Hegazy et al., 2010; Hua et al., 2005; Lewis and Whittaker, 2012; Ni and Jin, 2012; Swallow and Chanter, 2007) with a heavy reliance on accurate data and information technology because facility information needs to be updated so as to provide reliable information for facility operators and managers (Akcamete, 2011; Lin et al., 2006).

The process of asset maintenance management is sophisticated because it requires substantial information to be collected from many part of the organization to identify long-term trends (Lin et al., 2006). This makes planning asset operations a complex process which spans several years involving multi-participants. Its success relies on accurate and precise information in making complex decisions. According to Lin et al., (2006), the asset management planning process uses this information to plan and schedule asset maintenance, rehabilitation, and replacement activities. The information management system that captures, maintains, and provides the needed asset information is critical in providing effective asset management. The use of data within the information technology system of asset management accelerates the decision making process on adopting the right asset management strategy or policy,

but accurate decision making relies on reliable information. This is observed as a distinct challenge faced by asset managers when planning asset maintenance management operations (Faiz and Edirisinghe, 2009; Lin et al., 2006).

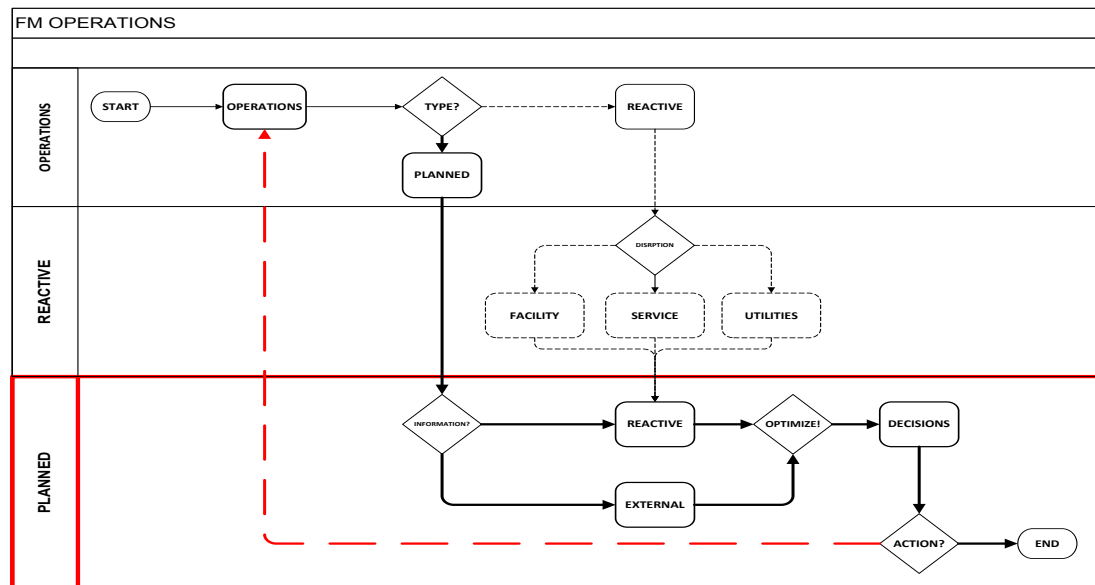


Figure 2.1. Facility operations management structure

To achieve proper information reliability for the decision making process, it is important to ensure data is adequately optimised to reduce redundancy when planning management operations of asset in complex systems. This ultimately mitigates the challenges of resource management. Unfortunately, data that constitute the makeup of this information is housed in different systems or in different formats. They are many-a-time lost, unstructured, inaccessible or repeated frequently making them unusable during the decision making process for planned asset operation. This kind of data may be termed “redundant data” and cannot be used in making accurate decisions. Thus information reliability cannot be assured and this presents a unique challenge to asset managers of complex systems. The consequences being incorrect, or a poor asset management strategy design being adopted resulting in the waste of resources i.e. time, capital (financial) and human during planning and which compromises safety, the environment or the organization.

This paper introduces a new philosophy in managing planned maintenance operations of assets by facility managers through facilitating information reliability. Section 2 examines information reliability, challenges and opportunities. Section 3 discusses a conceptual model of ensuring information reliability by facility managers. Section 4 discusses the methodology used in this study and the final section, 5, states the conclusion.

Information Reliability in Asset Operations

Ensuring information reliability in asset management operations has been an intense topic of research (Clayton et al., 1999; Hassanain et al., 2001; Kaya, 2011; Lin et al., 2006, 2007). Facility management operations inadvertently generate large amounts of data through its processes and this raises significant challenges in the quality of

information produced as highlighted by these researches. Facility managers rely on as-built information during the operations phase of the facility but this has been identified to be inadequate in providing the right kind of information needed for decisions in asset management and maintenance operating (Clayton et al., 1999). Decisions about facility operations and maintenance require integration of various types of information from different sources, some of which are in different formats and structures (Akcemete, 2011). As a result of this challenge, Akcemete, (2011), proposed an approach to capturing facility information taking cognizance of the changes that occurs during the operation phase of the building. It was argued that changes happen to facilities frequently due to maintenance and repair work, upgrades and renovations. Consequently, corresponding facility information needs to be updated so as to provide reliable information to facility operators and managers (Akcemete, 2011). This proposal relied on entering information during the operation phase on a standardised template produced by the facility managers. The objective was to streamline the capturing of maintenance and repair information when the activities are performed, so as to have a history of facility changes that can be used to understand how a building is deteriorating and to support facility information updates (Akcemete, 2011). But this poses a human factor challenge as humans are prone to errors and are resistant to change. Kobbacy et al., (1995) on the other hand noted that an effective maintenance function is a crucial element in successful operations and based on this argument went further to propose an intelligent maintenance optimization system. Based on this, the following features of the intelligent maintenance optimization system were identified:

1. Access the history data from a company's maintenance database
2. Check the quality of data
3. Recognize data patterns
4. Query the user for additional information, judgment, and criterion
5. Select the most suitable model for the analysis of the data
6. Estimate model parameters
7. Select and optimize the model to provide an evaluation of the current and proposed optimal maintenance policy
8. Present the results in a flexible format, including a recommendation for the future maintenance policy and a comparison with current practice
9. Respond to user enquiries, perform 'what if?' modelling and provide explanations of decisions
10. Self-learn and enhance the knowledge base (Kobbacy et al., 1995).

But they, Kobbacy et al., (1995), went further to note that some of the above features are difficult, if not impossible, to achieve using conventional systems. Thus before any form of system can be developed, a new approach to delivering and structuring facility information for use by owners and operators is required. Research efforts in building information modelling (BIM) have been undertaken to achieve this goal (Foster, 2011; Underwood and Isikdag, 2011; X. Zhang et al., 2009)

Criteria for information reliability have been outlined by Lin et al., (2006) which are accuracy, relevance, fineness, and timeliness. For this to be achieved, a systematic way to generating and obtaining facility data is required. But many factors impeded its achievement in an organization which includes inadequate management structures for ensuring complete, timely and accurate reporting of data; inadequate rules, training

and procedural guidelines for those involved in data collection; fragmentation and inconsistencies among the services associated with data collection (Lin et al., 2006). All these problems are typically associated with the dimension of the organization and the interaction of people within it. As this dimension cannot be controlled easily, strict measures need to be adopted in ensuring data consistency is achieved. Chen, (2002) have highlighted the use information technology as an important tool to provide an organization with quality information. This has been accentuated in the study carried out by Clayton et al., (1999). They posited that information technologies can actively and automatically retrieve and collect relevant information from data repositories in response to task-oriented requests by operations personnel. For this to be achieved, the right type of rules needs to be employed within the information technology system that coaxes users to providing the right type of information.

Moody and Shanks, (2003) outlines a framework for evaluating and improving the quality of data models in ensuring information reliability in a system. They utilized a quality management framework defined by an entity relationship model to enforce rule adherence to information quality. The purpose of the framework was to evaluate and improve the quality of application data models (Moody and Shanks, 2003). Holland et al., (2005), in a study of an asset intensive organization noted that the use of shared information system as opposed to data exchange system across traditional organizational boundaries resulted in improved performance of the asset operations via better coordination of participants. Finally, enabling technologies such as RFID, QR-Codes, Bar-Codes widely used in the logistics, manufacturing and retail industries have been found to enhance the efficiency of information use (Meng et al., 2008; Xie and Rui, 2010).

The Proposed Framework

The proposed framework for ensuring efficiency in planned maintenance operations of assets by facility managers through facilitating information reliability utilizes enabling technologies to ensure data is captured and transmitted in a format that will meet the quality criteria outlined by Lin et al., (2006) - accuracy, relevance, fineness, and timeliness. The components of this framework include data capture and tracking technologies (Radio Frequency Identification (RFID), QR-Codes, Bar-Codes, Sensors); Relational Database Technologies (RDBMS); Data Modelling Techniques (Object Oriented Modelling (OOM), Entity Relationship Modelling (ERm)) and Networks Communication (Virtual Private Networks (VPNs)) (Connolly and Begg, 2010; Y.T. Lee, 1999; Linn et al., 2000; Meng et al., 2008; Xie and Rui, 2010). The use of these technologies have revolutionized the logistic, manufacturing and retail industry thus enabling the implementation of a just-in-time philosophy towards delivering goods and services more efficiently. In asset management this technologies have been elucidated by Meng et al., (2008) but evidence of its use is rather limited.

During the planning process for asset maintenance management, it is important that information is captured from the reactive and planned component during the operations as to record the changes required to make accurate decisions in planning (Ali et al., 2002). This way, asset maintenance actions can be optimized more accurately. The framework for developing this strategy is described in Figure 4.1. The framework is a methodology to ensuring that relevant data is captured, transmitted and utilized in a way that satisfy the data quality conditions proposed by Lin et al.,

(2006). This begins by defining, structuring and describing the associated enabling technologies and data models. Explanations of these are stated below:

1. Enabling technologies: These are located within the asset location domain (Figure 4.1 and Figure 4.2) and are akin to information technology. They are apparatus that aid organisations in ensuring system processes are managed efficiently. It can be termed as an equipment or methodology that, alone or in combination with associated technologies, provides the means to enhance performance and capabilities of users. Within this framework, sensors, QR/Bar codes and RFID are used as enabling technologies for data capture and transmission. This satisfies the accuracy condition for data quality as proposed by Lin et al., (2006). These technologies are installed within the asset location and helps identify accurately the asset conditions and changes within the asset location (Figure 4.2). Their use would streamline business processes at asset locations and reduce delays (Gallaher et al., 2004). For these to be effective, there is the need for it to be defined and structured appropriately. This is discussed in the second point.
2. Object Oriented Modelling (OOM): This is a modelling technique used for specifying the data requirements that are needed within an application domain (Y.T. Lee, 1999). It forms the modelling domain and within this framework (Figure 4.1 and Figure 4.2), object oriented modelling (OOM) is used in defining the structure of components and describing the interactions between them (Figure 4.1). In this form of modelling, objects are identified and created within an application domain that includes not only code about data, but also instructions about the operations to be performed (K.E. Kendall and J.E. Kendall, 2002; Y.T. Lee, 1999). According to K.E. Kendall and J.E. Kendall, (2002), OOM techniques work well in situations where complicated systems undergo continuous maintenance, adaptation and redesign which is typical of asset maintenance management. Objects within this context is a representation of some real-world thing or event having attributes and behaviours (K.E. Kendall and J.E. Kendall, 2002) e.g. an air-conditioning system or a maintenance operator.
3. Entity Relationship Modelling (ERm): This is part of the FM/Contractor domain (Figure 4.1 and Figure 4.2). Entity relationship model are used to define system boundaries and elements that make up an organization (K.E. Kendall and J.E. Kendall, 2002). According to Y.T. Lee, (1999), the ERm is useful in modelling real problems and focuses on how concepts of entities and relationships might be applied to describing information requirements by describing the entity type, the relationship type, and the attribute type. The entity-relationship model can also be used as a basis for unification of different views of data (P.P.-S. Chen, 1976). Moody and Shanks, (2003), have used this approach to improve the quality of data models hence appropriate definitions can be applied to the entities interacting within the framework to ensure information reliability. An entity, as described by K.E. Kendall and J.E. Kendall, (2002), may be a person, a place or a thing. Within this framework, the entities will include the enabling technologies, the facility management team, contractors, clients, assets etc.
4. Relation database: This is a relational database management system (RDBMS) that forms the FM and Contractor domain (Figure 4.1 and Figure 4.2).The

RDBMS is used to store relevant data in a logical format (Connolly and Begg, 2010) and acts as a central source of data to be shared by many users for a variety of applications (K.E. Kendall and J.E. Kendall, 2002). According to K.E. Kendall and J.E. Kendall, (2002), the effectiveness objectives of a database are:

- a. Ensuring that data can be shared among users for a variety of applications
- b. Maintaining data that are both accurate and consistent
- c. Ensuring that all data required for current and future application will be readily available
- d. Allowing the database to evolve and the needs of the users grow
- e. Allowing users to construct their personal view of the data without concern of the way the data are physically stored.

It thus can be noted that this approach will satisfy the data reliability criteria of accuracy, relevance, fineness, and timeliness as defined by Lin et al., (2006).

By adopting this framework, asset management planners, operatives, clients and contractors can ensure that productivity and efficiency will be guaranteed. The proposed architecture for its implementation is presented in Figure 4.2. The architecture is divided into 3 parts: (1) the asset location; (2) the FM Operations – asset planning and management and (3) maintenance contractors. Within each part various devices are installed to attain information reliability. This approach proposes to be less prohibitive as the devices associated with this framework are inconspicuous in nature and less intrusive.

The description of each part is detailed below:

1. Asset location: within this location, RFID, QR/Bar Code, Sensors are installed on assets to be maintained or the location to be monitored. These devices are connected to the assets, as agreed within the business plan, and because they are less intrusive they make perfect tools for gathering data and information about a location or equipment.
RFID tag technology is used to tag/identify assets, speed up establishment and maintenance of the inventory and support total asset visibility (Gales, 2010; Meng et al., 2008; X. Zhang et al., 2009). This is achieved by providing persistent knowledge of the assets location and status (Meng et al., 2008). QR/Bar Codes are metacodes having access to data stored in computer memory which affords a high degree of accuracy for data entry through automatic capturing of data that can be used for tracking and forecasting of future needs (K.E. Kendall and J.E. Kendall, 2002). Sensors monitor changes in a system and can accurately collect data used for carrying out maintenance. The use of sensors has been discussed in research on intelligent building (Dibley, 2011; Elmualim and Pelumi-Johnson, 2009; Lucas, 2012; Wood, 1999). Within this framework, they can be used to monitor critical changes within the environment and collect statistical data used for accurate planning. All information and data collected by these devices can then be transferred over a network to FM Operations (Figure 4.2).

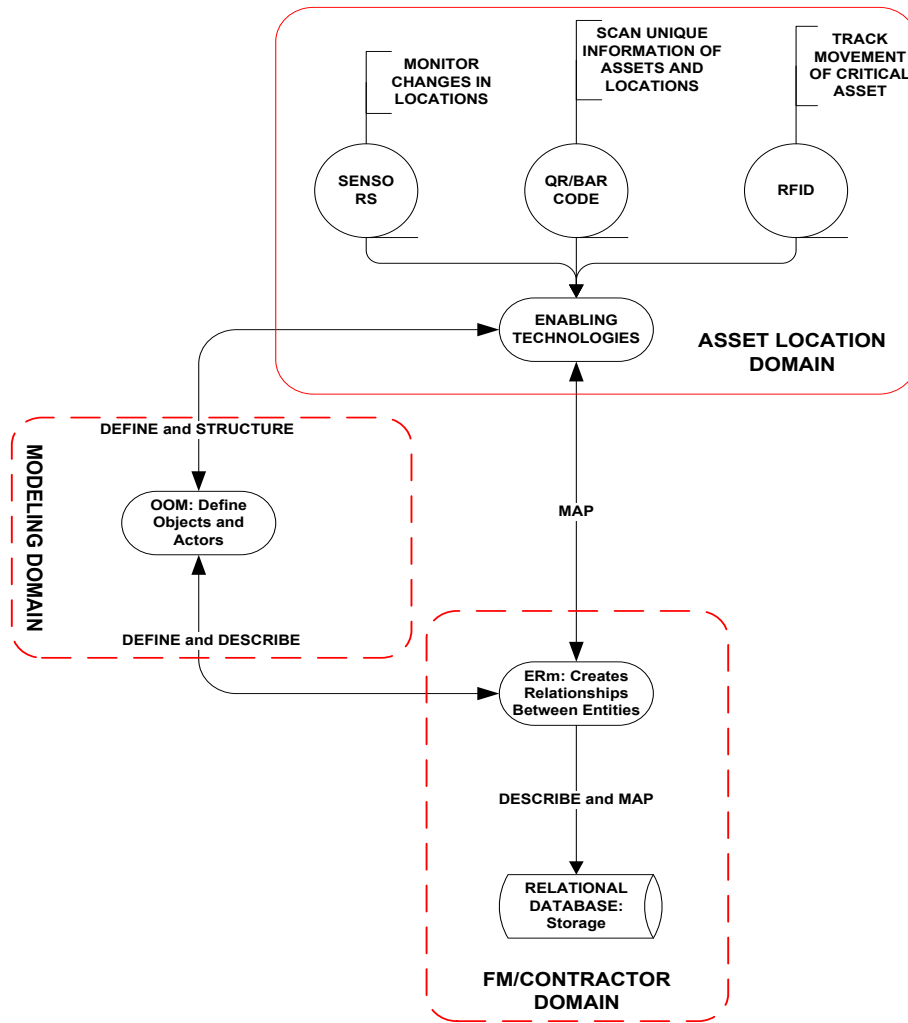


Figure 4.1. Information Reliability Framework

2. FM Operations: asset management, planning and coordination occur within this location. The activities performed here are critical for the smooth operations of client's facilities. There is a heavy reliance on data and information to make critical decision required for precision planning. Within this framework, the definition of entities and relationships are determined here. Firstly, the object oriented modelling (OOM) approach defines and describes the relationships within this section; secondly, entity relationship modelling (ERm) defines system boundaries and elements that make up an organization (K.E. Kendall and J.E. Kendall, 2002). It structures the data storage devices in a format that allows logical flow of data through process of normalization (K.E. Kendall and J.E. Kendall, 2002). Within this configuration, the sharing of a common platform is encouraged. This has been identified to enhance the productivity of asset management activities across traditional organizational boundaries in asset intensive industry (Holland et al., 2005). This is made possible by the definition of entities using OOM and ERM techniques (Y.T. Lee, 1999) and a virtual private network (VPN) (Figure 4.2).

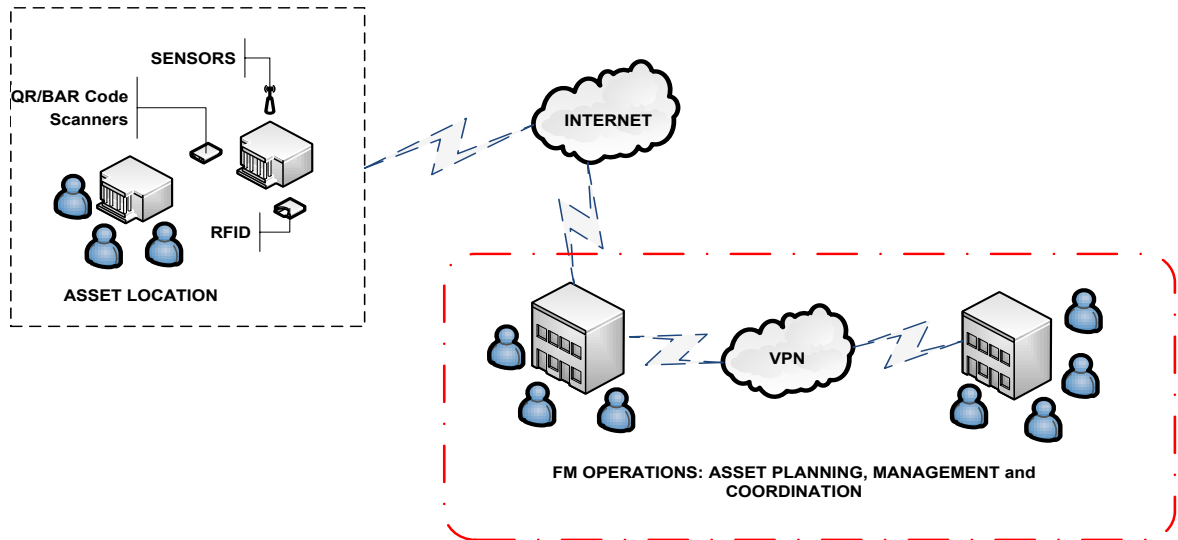


Figure 4.2 Asset Management Planning and Coordination Configuration

This framework is flexible and scalable and can be fitted in to BIM models for future development.

Methodology

The current research aims to introduce a new approach in managing planned maintenance operations of assets by facility managers through facilitating information reliability. This is a theoretical paper based on the author's conceptualization of information management in multi-enterprise organization. The approach to this study adopts a qualitative perspective, which guides the process of inquiry through gathering insight into the problem. The rationale for using a qualitative research approach is based on the theoretical nature of this paper.

By adopting a theoretical basis, it creates a condition for further and in-depth exploration of the proposed concept. Its assumptions determine the choice of methods adopted in the research study (Grix, 2001). According to Conboy et al., (2012), qualitative research aims to empirically investigate a variety of phenomena through qualitative data from a variety of sources. Such sources could either be primary or secondary. Data collection and interpretation for this paper was achieved by way of secondary data collection and analysis (Bloomberg and Volpe, 2008; Bryman, 2008; Price et al., 2011). This allowed for high-quality data to be collected from case-studies and re-analysed using an iterative process offering new interpretations (Bryman, 2008). Through using this practice, a greater insight into the problems was attained (Bloomberg and Volpe, 2008). To ensure rigor in the entire process of data analysis, a knowledge development framework with a '3A' i.e. Adequate, Available and Applicable, principle was developed and utilized (Figure 5.1). This process seeks to guarantee knowledge adequacy, knowledge availability and knowledge applicability.

Using this framework, the research begins with an analysis of the knowledge required (needed and available) for the research (*K1*) (Figure 5.1). Where such knowledge was found to be inadequate, knowledge from other sources (*K2*) was utilized which formed part of the literature review. Using this helped validate *K1* and in this way,

new knowledge was created (*K3*) which was the approach to ensuring information reliability. When such information is applicable, lessons can be learnt from the process and if found to be adequate, a new theory, concept or approach can be adopted. This framework is designed to iterate through the knowledge blocks (*K1*, *K2*, and *K3*) to ensure rigor in the knowledge delivery process.

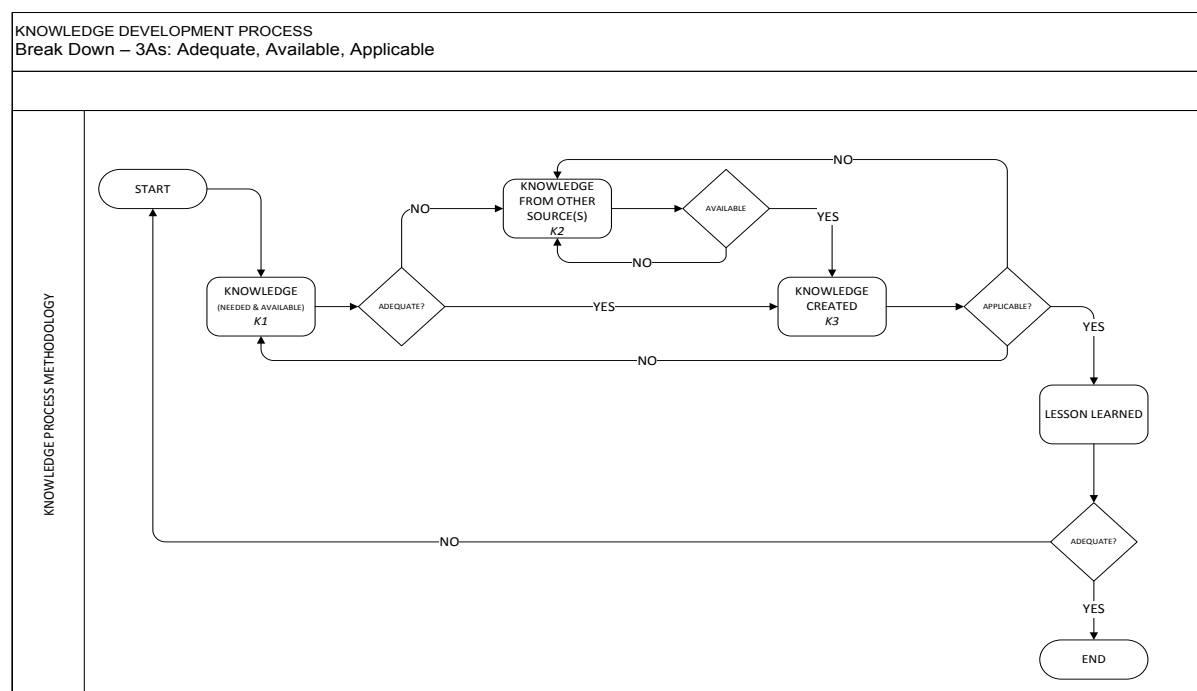


Figure 5.1 Knowledge Development Framework

Conclusion

Significant changes in the economy due to competition, sustainability, cost management, risk management and people management, have prompted calls for better and innovative approach to ensuring organization assets are well maximised. As organisations are pressured to make savings, cut cost and increase shareholders benefits, due to increase competition in the business environment (Paz & Viriyavadhana 1995; Keith 2003; Lavy & Shohet 2007; Swallow & Chanter 2007), infrastructure owners and managers are tasked to seek methods of better utilization of assets to achieve corporate goals and vision (Alexander, 2003; Jones and White, 2012). The way of achieving this is through an effective asset maintenance management delivery.

These are challenging activities that require significant restructuring of the organization to achieve significant value which requires a rigorous planning regime that relies on accurate data and information.

The rationale for facility management to optimise its process through efficient data and information management to add value to the bottom line is a huge task and presents a major problem in many service related organization. This forms part of the reason why many client-facility management relationship have failed, resulting in loss of vital resources i.e. business, human capital and financial investments. Hence a new and sustainable approach needs to be adopted. This can be achieved through the

proposed framework to provide the technology for facility information to be updated in real-time so as to provide reliable information for facility operators and managers (Akcamate, 2011; Lin et al., 2006). This will ensure efficiency in planned maintenance operations of assets by facility managers through facilitating information reliability utilizing enabling technologies to ensure data is captured and transmitted in a format that will meet the quality criteria outlined by Lin et al., (2006) - accuracy, relevance, fineness, and timeliness. This framework is flexible and scalable and can be fitted in to BIM models for future development. This framework shall be validated through expert workshops.

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Improving Building Information Handover Practices in Saudi Public Sector Construction Projects

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Abstract

Many public sector construction projects in the Kingdom of Saudi Arabia (KSA) are marred by communication and co-ordination problems, with owners having to pay a high price for schedule delays and cost overruns. The process by which building information is conveyed to owners lacks standardization and consistency. This often results in KSA public sector owners receiving building information in a variety of formats. This paper is prepared as the initial publication of a PhD study aimed at developing a framework for the smoother handover of information in Saudi public sector construction projects. The development of a framework is proposed to help improve the operation and maintenance of buildings by establishing a relationship between the design and construction team, and the operations and maintenance team. The paper highlights the need to develop a framework supported by new methods, technologies and business practices that optimally serve the information requirements of public sector building owners.

Keywords

Building information management, construction industry, energy efficiency, facility management, information handover.

Introduction

The Kingdom of Saudi-Arabia (KSA) has one of the fastest growing construction industries in the Middle East, fuelled by a rising demand for commercial, residential and retail projects. Due to oil industry profits, the construction industry in KSA has grown rapidly in the last decade. These profits have also facilitated the growth of infrastructural projects, such as new airports, universities, hospitals and modern cities, to meet the demands of the commercial, residential and governmental spheres. Growth in the KSA construction market is also fuelled by the presence of two holy mosques, in Macca and Al-Madinah, attracting millions of pilgrims each year.

The construction industry in KSA has various distinctive characteristics. It employs a multi-cultural and multi-lingual workforce from developing countries such as India, Bangladesh, Pakistan and Egypt. The Saudi construction workforce is very diverse in terms of its education, culture, practical skills training and language. Even though Arabic is widely spoken in the country, it is not always understood by the construction workforce because of differences in pronunciation and accent. The multi-cultural background of the workforce also means that the way in which different technical terms are documented and interpreted, and the way in which business is conducted, varies a great deal from one project to another. A lack of standardised approaches

often results in owners receiving piles of scrambled documentation at handover stage. The lack of a clearly defined framework results in buildings operating at sub-optimal level during the building life-cycle. Even in cases where contractors transfer a rich data-set to owners during building handover (such as warranties, manuals, equipment details), there may be a gradual degradation of the information over the building life-cycle. The purpose of this paper is to identify factors and gaps relating to information handover in the construction industry with a view to devising guidelines for narrowing the gap between the design and construction phase, and the maintenance and operation phases in Saudi Arabia. This will facilitate the later development of a framework that can help in filling this gap and thus potentially providing construction management with a competitive advantage.

In recent years, the Saudi government has placed increasing emphasis on sustainability and energy-consumption reduction (Abaoud and Veziroglu, 2002). The drive towards energy-consumption reduction is driven by rising fuel prices as well as the fact that KSA is a signatory to international treaties like the Kyoto Protocol and is therefore obliged to reduce its current CO₂ emissions (Barnett et al., 2004; Hashmi and Habib, 2013). A vast amount of energy in KSA is consumed by buildings. Because of the extreme Saudi climate, HVAC (Heating, Ventilation and Air Conditioning) plants operate on a relatively high 24-hour load. Additionally, because of large energy subsidy provided by the government, public sector buildings are typically not operated in the most energy efficient manner and therefore incur high operating costs. The need for innovative approaches to energy-consumption reduction in public sector buildings to reduce costs and to facilitate conservation is being rapidly recognised (e.g., Alajlan et al., 1997).

High building operating costs also result from a lack of a holistic approach to building design, construction and operation. Public sector projects in KSA are procured using traditional routes, often resulting in communication gaps between designers, contractors and owners. Inefficiencies resulting from such communication and co-ordination problems are well documented in the recent literature. For instance, Abdul-Hadi et al. (2005, p. 307) describe how the Saudi construction industry is affected by problems in “productivity, innovation, slipping schedules, rework, mistakes, disputes, and increased construction costs”.

While there is lack of empirical data from Saudi Arabia, a study conducted in the US (Gallaher et al., 2004) shows the phenomenal cost to building owners and operators due to inadequate interoperability (Table 1). Generally, interoperability problems have been well researched within the construction industry, and scholars have attributed various causes for such problems, including: 1) the fragmented processes in the construction industry, 2) the paper-based nature of information processing, 3) the lack of use of advanced Information Technology (IT), 4) the absence of clear protocols or frameworks to organise the information handover between stakeholders during and after the final phase of the project.

Such communication gaps are particularly evident in the building operations and maintenance phase. In traditional project delivery, designers and contractors walk away after building commissioning. The design and construction team does not carry any liability once building handover has been completed. However, the majority of expenses are incurred and problems are encountered during the operations and maintenance phase of a building. As a result, many public sector buildings operate at

a sub-optimal level and are unable to meet design expectations. This results in buildings operating at a high cost, often resulting in user dissatisfaction. Also, an inconsistent approach in the building handover stage can result in building data being maintained in a variety of different formats such as drawings, photos, manuals, 2D CAD drawings, and specifications.

Table 1: Costs of inadequate interoperability by owners/operators, by life-cycle phase (in \$millions) (Gallaher, 2004)

<i>Stakeholder group</i>	<i>Planning, engineering, and design phase</i>	<i>Construction phase</i>	<i>Operations and maintenance phase</i>	<i>Total</i>
<i>Owners/operators</i>	<i>\$722.8</i>	<i>\$898.0</i>	<i>\$9,027.2</i>	<i>\$10,648.0</i>

Various Total Quality Management (TQM) approaches have been used recently in Saudi Arabia to ensure that construction projects comply with owner quality requirements. Some of the most popular TQM approaches currently used, particularly in the Saudi oil and gas sector include Quality Assurance (QA), Quality Certification (QC) and Quality Inspections. The latter are often used as a quality control strategy to ensure that quality work has been undertaken. Various methods are involved including inspection of workmanship and testing of the materials and products used. Even though some projects have reported the use of quality inspections, their use is not currently widespread across Saudi Arabia.

The value of this information diminishes over the life-cycle of a building and often information is not readily accessible during the operations and maintenance phases as required. Given the increasing complexity and sophistication of modern-day building, this dearth of information has serious ramifications for efficient building operations. Thus, there is a need to develop a holistic approach to manage, capture and transfer building information.

To this end, new opportunities are emerging as a result of technological innovation such as BIM (Building Information Modeling) that allows for progressive collection of building data and could play a key role in streamlining the data collection process. BIM has the potential to be used as a platform to research and publish information by engaging a variety of stakeholders due to its user-friendly 3D visualisation.

This concludes an introduction to building information handover practices in Saudi public sector construction projects. This is followed by presentation of the research methodology and review of the key literature. The last Section presents the framework. The final section presents key conclusions and recommendations.

Research Methodology

First, an extensive literature review will be conducted to understand best practice and key industry trends in the use of building information by owners. Various technology approaches offered by key construction industry software vendors will also be reviewed. Finally, existing project handover case studies will be reviewed to ascertain the extent to which project requirements are being met effectively using existing project structures.

A detailed survey will be conducted to capture the experiences of Saudi public sector building users and to better understand end-user requirements, operational challenges, and current technology utilisation for facilities management. This survey will be administered using an online survey system and will target KSA public sector building users. Semi-structured interviews with key building maintenance staff will also be conducted to obtain rich insights about key research issues. These interviews will be used to obtain information from building users about such issues as work order logs, maintenance budgets and maintenance processes. A process mapping approach will be used to map current processes and work flows and to design the new processes, while utilising new technologies. Current and new process maps will be validated in interviews with industry experts.

Literature Review

A recent study carried by Jordani (2010) concludes that the data saved in BIM during the design and construction phases must be routed into a range of Facility Management (FM) software applications to be really effective for use. Accordingly, they suggest the use of an accurate 3D geometry of a facility as a platform for accessing related information such as building spaces, contracts, warranties, repair-history, schedules, systems and components. Singh et al. (2011) suggest using the link between BIM and available communication systems and IT using Web Services Infrastructure to facilitate the communication between the owners and other stakeholders.

Bringardne (2010) and Redmond et al. (2012) propose the use of the cloud network i.e. data on remote servers on the Internet, in the job site to minimise interoperability problems. Bringardne (2010) advocates the use of tablets instead of drawings during the construction phase to provide easy access to and updating of the project information at the job site. Although the proposed technique is useful, the study does not provide a clear vision of how the facility owners and/or operators can use such promising tools in the maintenance and operation phases. We share the view of both Bringardne (2010) and Redmond et al. (2012) that the instantaneous update of project information is the best means of providing accurate information for the maintenance and operation phases.

Conceptual Framework

In the construction industry, a framework could be defined as a data structure with typical knowledge about a facility to provide a means of organising and updating the facility information. The information can be saved in slots to demonstrate the facility's characteristic attributes. The presence of Frame-based expert systems (FES) can link the construction phases together. The engineers in each phase would be

required to add the project information and any updates in a single FES, where each phase could be presented in its own sub-FES. The entry and update of the project information in the FES should be organised in terms of a framework that facilitates interoperability and professional authorisation in each phase.

Owners should have the full authority to read, remove, update or add information in all phases. The principal engineer in each phase should have full authority, within their own sub-FES, to read, write, upload, update and remove data, but in the other phases they should have the right to read (and write notes) only. The entry and/or update of information should be time-stamped automatically by the authorised engineer to ensure that the flow of the work is well-synchronised from a chronological point of view. FES could be coupled with an Intranet to be distributed to the stakeholders of the project while retaining the entity of the software as a centralised system.

The authorisation of the stakeholders in each phase should facilitate interoperability from the project kick-off and continuing throughout the project life-cycle, with records of the maintenance and operation phases retained for future plans. Moreover, to utilise the full potential of FES, FES must be integrated with BIM in the internal levels in the design (planning) and construction phases. The design of the sub-FSE for each stakeholder group requires a deep understanding and analyses of their needs and their relations with the other stakeholder groups.

FSE can be considered as a management system containing BIM, to support owners in managing the construction processes and following the maintenance and operation processes throughout the life-cycle of their facilities. Combining the FSE system with (wireless) communication tools such as tele-presence systems on the job site using cloud computing (Redmond et al., 2012) can help to decrease cost overruns related to delays, information updates and paper printing. Since the construction information and the update details are provided and saved in a single location or system (such as a server), the teams for the maintenance and operation phases can run their operations and include their remarks, updated information and forthcoming plans and projections in the system. On the other hand, owners have full control of the system; they can therefore follow the operations, take the lead in the maintenance and operations phases, and guide the teams based on their previous knowledge in addition to utilizing the tools available on the system.

Discussion and Conclusion

This research has highlighted the need to develop a framework to ensure the smooth transition of information from the design and construction teams to the building owners. Given recent developments in the area of Building Information Modeling (BIM) and supporting processes, it is possible to build information assets progressively over the life-cycle of a project.

This research will further investigate the relevance of these concepts in the context of the Saudi construction industry. An online survey questionnaire and interviews will be used to gain an understanding of the information requirements of building owners. Existing project handover case studies will be reviewed to ascertain the extent to which these projects' requirements are being met effectively using existing project structures. Based on a gap analysis, a framework will be proposed and validated to guide the effective use of building information across the project life-cycle.

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Reinforced Aer-Tech Novel Material A Structurally Vaible Material

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Abstract

The Aer-Tech material described as cementitious material with more than 10% of foam entrained in a plastic mortar was initially envisaged as a void filling and fireproofing material, categorize as a lightweight concrete composed of cement-bonded material that is manufactured by blending a very fluid cement paste (slurry) or mortar with incorporated manufactured foam mixing together in an automated proportion. Appreciably, recent research findings have shown great structural potential. The structural effect of Aer-Tech material conforms with the analogy as stated in (Moseley, Hulse and Bungey.1999) that areas of tension on a reinforced Aer-Tech material are prone to undergo cracking. Ultimately, the ductility of reinforced Aer-Tech beam is primarily important in justifying structural capability of the material. Since, from structural standard, it is paramount for a ductile structural material to undergo large deflection at near maximum load carrying capacity, by providing ample warnings to an impending failure. This paper had shown clearly that Aer-Tech material displacement ductility ratio taken in terms of $\mu = \Delta_u / \Delta_y$, which is the ratio of ultimate moment to first yield deflection. Where, Δ_u is deflection at ultimate moment, Δ_y is deflection when the steel yield. In general, high ductility ratios confirm that structural member is capable of undergoing large deflection prior to failure. Consequently, the result of this investigation on Aer-Tech material poses relatively good ductile characteristics as beam shows clear signs of cracks on its beam long before failure. Other results of Aer-Tech material stress and strain behaviour had further confirm Aer-Tech material as a structural reliable material comparable to conventional concrete since the ultimate experimental failure load of Aer-Tech material is 38.7KN, whilst the theoretical calculated ultimate load is 35KN. The nearness of experimental and theoretical failure load confirms structural capability of Aer-Tech material.

Keywords

Aer-Tech material, deflection, investigating, lightweight, material, structural.

1. Introduction

Aer-Tech has evolved out of concrete but differs in replacement of stone aggregate with air cells. The Aer-Tech machine equipment uses a patented screw, mixing system and atomised liquid dosing system which produces a regular, consistent homogeneous mix. The atomiser injects air cells as small as 20 micron into the mix

replacing the stone aggregate and the mixing screw mixes sand, cement and water with consistency and even distribution, creating a geodesic structure. The consistent structure created provides the strengths achieved without using any stone aggregates. This remarkable consistent distribution of air cells creates a geodesic structure, which in effect makes the material unique.

Similar studies have shown that base mixes of uniform distribution of air-cells in a plastic mortar give a higher strength (Nambiar and Ramamurthy, 2006). It is also said that bigger pores in a base mix influence the strength. This is correct as the pore system in cement-base material is conventionally, classified as gel-pores, capillary pores, macro- pores due to deliberately entrained air. However, the gel pores do not influence the strength of Aer-Tech material through its porosity. But the capillary pores and other large pores are responsible for reduction in strength and elasticity (Neville and Brooks, 2004).

2. Experimental Programme

2.1 Material and mixture composition

The constituent material used to produce Aer-tech material were comprised of: Pro-chem cement conforming to BS8110, pulverized river sand finer than 300 μ (specific gravity 2.5), and foam produced by aerating a foaming agent (Aer-Tech Sol) (dilution ratio 1:5 by weight) using an indigenously Aer-tech machine calibrated to a density of 1810kg/m³.

3. Results and analysis

Three reinforced beam were tested for each Aer-Tech mix of 4.78:1, 4.44:1 and 5

Table 1: Experimental strain

Load	Demec1	Demec2	Demec3	Demec4	Demec5
0	0.00908	0.00916	0.009317	0.00943	0.008814
3	0.009084	0.009148	0.00968	0.009793	0.009184

3.1 Reinforced Aer-Tech Material Strains and compressive stress

Specifically, the strain results on reinforced Aer-tech beam were measured in every load increments. The strain distribution results are presented in table .1.

More so, at the given service load of 3KN to 30KN the strain results ranges from 2283x 0.403x10⁵ to 3035 x 0.403x10⁵. Whilst, the measured strain just prior to failure varied from 3198x 0.403x10⁵ to 3231x 0.403x10⁵ respectively. **Fig.2** shows the strain distribution effect in Aer-Tech material on application of load. The strain diagram confirms that strain occurs across the depth of the beam. The illustration in fig1.2 show clearly that demec strain reading does reduces at the top on increasing load for demec 1 and 2, but increases as load increases on demec 3, 4 and 5. This behaviour is supported by the bending theory that plane section of a structural member remain plane after straining. Importantly, results obtained are consistent with works of other researchers (Hillerborg A., M. Modeer and P.E. Petersson.(1976).

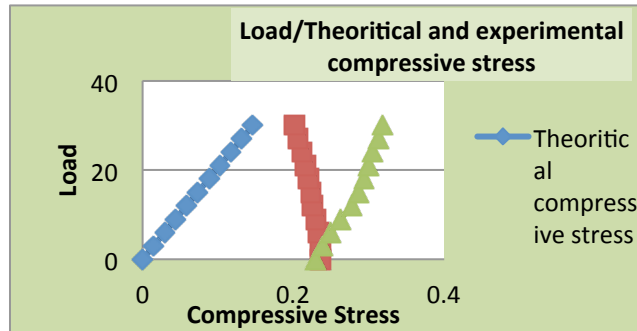


Fig .1 Against Theoretical and experimental compressive Stress

The illustration on figure .1 shows that the theoretical compressive stress and experimental stress of demec 5 are directly proportional to load application. Explicitly, what happens is that the greater the load application on an aer-Tech material the higher the compressive stress effect developed.

More so, this significant structural behaviour of Aer-Tech material do lead to first appearance of cracks at the bottom of the reinforced Aer-Tech beam. Intrinsically, as the load increases from 3KN to 12KN the initial slight crack appearance becomes more noticeable. These cracks are simply known as diagonal tension cracks. The structural effect of Aer-Tech material conforms with the analogy as stated in (Moseley, Hulse and Bungey.1999) which state that where ever tension occurs in a material, strongly indicates greater chances of crack appearance within same place.

Comparatively, using the values of experimental strain at the top surface of the beam (demec 1) and the bottom base of the beam (demec 5) by calculating the theoretical result using $f = E_c \times \epsilon_c$ from the figure and the table, it could be observed that the theoretical results are lower than the experimental ones and that could be because the material matrix is getting disturbed, or it could be because the theoretical values are values without any losses that could be due changing the area of the beam surface or due to shrinking.

3.2 Beam behaviour in service and collapse

Ultimately, all beams showed typical structural behaviour in flexure. Also, during the test of the three beams no horizontal cracks were observed at the level of the reinforcement, which confirms non occurrence of bond failure.

3.3 Deflection Behaviour Of Aer-Tech Singly Reinforced Beam

Fig.3 shows that experimental deflection is lower than the theoretical deflection. The illustration of load against deflection graph confirms that in both experimental and theoretical results, the relationship between load and deflection is linear.

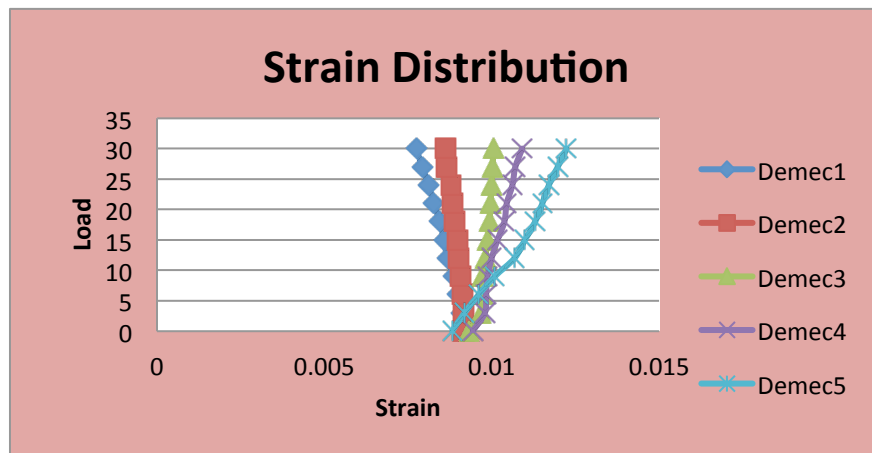


Fig.2 Strain Distribution Effect

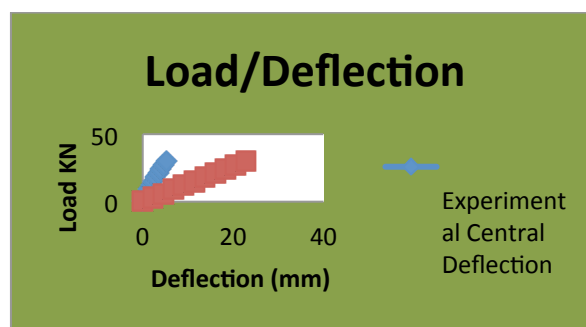


Fig .3 Experimental and theoretical deflection values for reinforced beam mix one

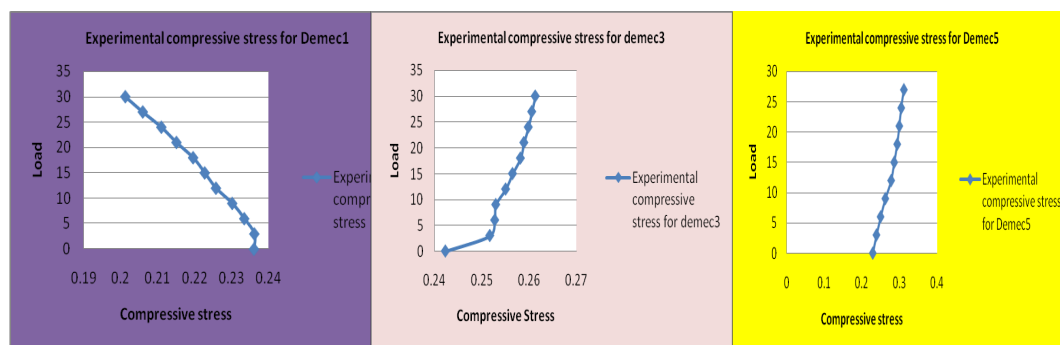


Fig .4 Load Against compressive Stress for Demec 1,3 & 5

3.4 Reinforced Aer-Tech beam Ductility Behaviour

Ultimately, the ductility of reinforced Aer-Tech beam is primarily important in justifying structural capability of the material. Since, from structural standard it is paramount for a ductile structural material to undergo large deflection at near maximum load carrying capacity, by providing ample warnings to an impending failure confirms, ductility of tested Aer-Tech reinforced beam. Thus the displacement ductility ratio is taken in terms of $\mu = \Delta_u / \Delta_y$, which is the ratio of ultimate moment to first yield deflection. Where Δ_u is the deflection at ultimate moment and Δ_y is the deflection when the steel yield. In general, high ductility ratios

confirm that structural member is capable of undergoing large deflection prior to failure. Consequently, the result of this investigation on Aer-Tech reinforced beam ductility, shows that Aer-Tech material possesses relatively good ductile characteristics as beam shows clear signs of cracks on beam long before failure. This can be attributed to its inherent pore structure formation due to foam content

3.5 Modes of failure

Aer-Tech reinforced beams had different modes of failure as shown in Figure 1.5. Consequently, the beam failed in total bending. The ultimate experimental failure load of Aer-Tech material is 38.7 KN, whilst the theoretical calculated ultimate load is 35 KN. The nearness of experimental and theoretical failure load confirms structural capability of Aer-Tech material.

Appreciably, the theoretical failure load calculated in accordance to BS8110, obviously lower than the failure load derived from the lab. Their differences are probably caused by the assumption that the compressive and tensile forces were equal. However, the strain distribution diagram shows that strain at the bottom is greater than the strain at the top. Apparently, what happens is the theoretical failure may not have taken into account that the tensile stress is still subjected to the reinforcement bars after the concrete has cracked. Whilst, in case of the experimental failure load a higher experimental failure load was achieved, since the steel reinforcement in the beam continues taking the tension developed until it reaches its ultimate yielding point where it no longer could withstand any further load increase, it therefore breaks at a higher ultimate failure load as compared to theoretical failure load.

But by measuring the angle of the crack in **Fig.5** it was found to be 35° which indicated that the beam failed in combined mechanism of bending and shear stresses.



Fig.5 Mode of failure for Aer-Tech Reinforced beam

4. Conclusions

The experimental investigation of reinforced Aer-Tech beam has shown that Aer-Tech structural behaviour is comparable to other lightweight concrete. Below are some of the conclusions made, based on experimental results.

- Structural assessment Aer-Tech material has shown that the Aer-Tech beam suffered tension at the bottom and compressive forces at the top, which resulted in the diagonal tension cracks being produced mid span at the bottom of the beam.
- Also result of reinforced Aer-Tech beam had shown that as load application increases on reinforced beam tension increases until failure occurs.

- The experimental performance of a 28 days Aer –Tech beam test, has shown that the experimental ultimate moments of Aer-Tech reinforced beam is 3.62% higher than the theoretical ultimate moments.
- The deflection of Aer-Tech material calculated using BS8110 under service load can be used to give reasonable predictions. More so, the deflection under the service load for singly reinforced beams were within their allowable limit provided by BS8110.
- Importantly, the Aer-Tech reinforced beam test gave a high elastic modulus of 25.99 MPa, an indication Aer-Tech material of the flexural capability.

Acknowledgement

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A Conceptual Framework for Emergency Preparedness in the United Arab Emirates (UAE)

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Abstract

Globally, it is estimated that natural disasters were responsible for more than 535,000 fatalities during the past decade, with direct damage to infrastructure and crops totalling more than \$684 billion. Such figures highlight the importance of investing in the science of Emergency Management (EM) as the means of saving life and property by increasing capabilities to mitigate against, prepare for, respond to, and recover from all kinds of hazard. Research established in the field shows that there are a number of standards and models that strategically address the main phases of emergency management, which have been adopted by developed countries. The aim of this paper is to create a conceptual framework of emergency preparedness for the UAE in order to increase the capacity for preparedness to respond, in a professional manner, to all kinds of hazard. With this in mind, this paper reviews international standards of emergency management in general, including those of the UAE, as well as the various frameworks and models concerning preparedness in particular. This will allow the identification of the key elements which effect preparedness.

Keywords

Emergency Management, Emergency Management Standards, Emergency Preparedness, Preparedness Frameworks, UAE.

1. Introduction and Background

Disasters have always been present in human history (Haddow *et al*, 2011). However, the world has reacted, and since the Second World War governments have created acts to reduce and prevent disasters (O' Brien, 2005). Some countries are leading the field in their standards and practice adopted. However, one of the countries which is still vulnerable is the UAE. The UAE is one of the Arab countries, sharing its borders with Oman to the east and Saudi Arabia to the south, as well as with Qatar and Iran. The UAE is a federation of seven emirates, each governed by a hereditary emirate but operating under a single national president (UAE Interact, 2012).

As noted by Dhanhani *et al* (2010), the natural disaster risk for the UAE is surprisingly high. Taking Fujairah as an example, "the following rapid onset natural hazard events have occurred in the period 1995-2009: Masafi earthquake 2002, Al Qurayah flood 1995, Al Tawaian landslide 2005, tropical storm Gonu 2007 and Sharm flash flood 2009".

Setting aside past disasters, the UAE will certainly face significant challenges in dealing with hazards, whether environmental or man-made. As one of the most dramatically growing nations in the world, the UAE is at particular risk. For example,

over 500 UAE skyscrapers have panels composed of flammable material (Gulf News, 2012), which significantly increases the potential for serious damage, should an accident occur. However, the nature of construction is just one factor. The UAE has a huge amount of air traffic due to its status as a popular tourist destination and international travel hub, thus carrying a risk for air accidents. Indeed, there have been notable air crashes in Dubai and Sharjah (Li, G. and Baker, S. 2007). However, although disasters have occurred in the past and are likely to occur in the future, there is no well-defined strategic plan on how to deal with these disasters or at least to prepare for them, as emergency management standards lag some way behind economic status. As Dhanhani et al (2010) showed, in an interview with the Director-General of (NCEMA), as recently as 2010 progress was still ongoing in order to improve the capacity of the UAE to deal with all kinds of threat. Furthermore, it was recommended by Jordan et al, (2005) that any construction along the eastern coast of the UAE involves tsunami mitigation planning, including public education. This is a cause for concern in the UAE and provides the researcher with a strong rationale for the creation of an emergency preparedness framework.

This paper will provide a review of the literature regarding standards used in developed countries; it will study the profile of the UAE as one of the Gulf countries vulnerable to disasters, and review existing frameworks and models in the body of knowledge in order to identify the key elements which effect emergency preparedness.

2. Literature Review

2.1 *Emergency Management: Concepts and Strategies*

This section provides a summary of the literature review conducted in this paper in order to identify a suitable definition for EM, and a summary of existing standards applied in the developed world in general and the UAE in particular. It also seeks to explore the various frameworks and models in preparedness in order to identify the key elements which effect emergency preparedness.

2.2 *Definitions of Emergency Management*

Literature shows that the term ‘emergency management’ can be found in many different sources. EM, according to Kelly (1996), is the range of activities designed to maintain control over emergency and disaster situations and to provide a framework to help those at risk to avoid or recover from the impact of the disaster. Whereas Michigan Dept of State Police (1998) defines EM as, "a comprehensive system of policies, practices, and procedures designed to protect people and property from the effects of emergencies or disasters. It includes programs, resources, and capabilities to mitigate against, prepare for, respond to, and recover from effects of all hazards." Since this definition provides a general framework for different types of situation, rather than concentrating on a specific kind of event, it will be adapted as a research definition.

2.3 *Emergency Management Standards in Developed Countries*

This section provides a summary of international standards for emergency management. Here, the standards for the US, UK, Australia, Japan and the UAE will be examined, in order to explore how these standards are applied in these countries. When the various approaches are studied, distinct similarities are apparent between

the principles of emergency management in the US, UK, Australia and Japan. This paper will consider these standards regarding the approach, cycle, level of responsibility and main characteristics.

A. Approach: Having looked at these countries, it is apparent that the US, UK and Australia all follow, roughly:

- The Comprehensive Approach: which includes the Preparation, Prevention, Response and Recovery (PPRR) phases (Emergency Management Australia, 2004, FEMA, 2007, Cabinet, Office, 2009). These are not separate linear segments, independent of each other, but rather can overlap and run concurrently.
- The All Hazards Approach: working on the basis that many risks cause similar outcomes requiring similar responses, this approach involves managing a wide range of possible crisis outcomes (Emergency Management Australia, 2004, FEMA, 2007, Cabinet, Office, 2009).
- The Integrated/All Agencies Approach: which includes the involvement of government agencies such as local councils, emergency services such as police, fire, ambulance, as well as NGOs such as local community groups and volunteer organizations. (Emergency Management Australia, 2004, FEMA, 2007, Cabinet, Office, 2009).

Japan, however, differs significantly in its approach to emergency management and has no comprehensive concept (Fukami, Hisamoto 2010). Unlike the other three countries studied, Japan has no one government body or Act which deals with this issue. For example, according to Fukami, Hisamoto (2010), there are 18 laws dealing with prevention and preparedness alone.

B. Cycle: The US process of emergency management involves four phases: prevention (or mitigation), preparedness, response, and recovery (or rehabilitation). (Green, 2002; Waugh, 2000; Godschalk, 1991). Whereas, Australia works on the US system and follows the “4 phases”, the UK Cabinet Office works under six phases in its emergency management concept: anticipation, assessment, prevention, preparation, response and recovery (Cabinet, Office, 2009). According to the Government of Cabinet Office Japan (2011), Japan works under six phases: prevention, mitigation, preparedness, emergency response and recovery and rehabilitation. The difference between Japan and the UK is the first four phases work under the preparedness department.

C. Level of responsibility: It can be observed that levels of responsibility relating to emergency management in all four countries follow the lines of their national system of government. Therefore, in the UK, at national, regional and local level; in the US at national, state and local level, in Japan at national, prefectural and municipal levels, and Australia has three levels of government, headed by the Commonwealth, the lower tier – local government (Shaw *et al*, 2003).

D. Main characteristics: It can be seen that the US, UK and Australia adopt a decentralized “bottom-up” approach, whereas Japan adopts a centralized “top-down” approach. In addition, the US and UK approach is closely

linked to prevention of terrorism, whereas Australia and Japan concentrate on disaster issues.

Table 14: Different Approaches to Emergency Management in Four Different Countries

Country	Approach	Cycle	Levels Of Responsibility	Main Characteristics
US	Comprehensive and integrate	Four phases	Three levels: government-state-local	Terrorism Decentralized
UK	Integrated EM	Six phases	Three levels: government-area-local	Decentralized
Australia	Comprehensive	Four phases	Two levels: commonwealth (state)-local	Decentralized Volunteerism
Japan	No official approach	Six phases	Three levels: government-prefecture-local	Centralized/“top down” Preparedness Complex Disaster-specific laws

Therefore, in studying the EM standards of these four developed nations, it is possible to see that standards have been in place for a long time which help them to deal with all kinds of hazard. Having examined these international standards, in the following section the study will explore the standards applied in the UAE, in order to identify if there are any weaknesses in comparison with developed countries.

2.4 *Emergency Management Standards in the UAE*

Having looked at the standards in developed countries, and the types of emergencies which are being faced, it is time to identify to what extent the UAE’s standards compare. Therefore, this section explores the existing standards for coping with emergencies in the UAE.

At the beginning of the 1990s, emergency management in the UAE was limited, and lacking in any form of emergency plan (Dhanhani *et al*, 2010). It was not until 2007 – the year of tropical storm Gonu – that an organization was set up specifically to deal with the management of emergency and crisis situations. An increased level of awareness with respect to natural disasters and the changing needs of a fast-developing nation led to the creation of the National Crisis and Emergency Management Authority (NCEMA). Governed by the Higher National Security Council (HNSC), NCEMA’s aims are to: “ensure the safety of the lives of all citizens and residents on the territory of the United Arab Emirates and to preserve the property of the country to enhance the UAE’s capabilities in managing crisis and emergencies by: setting the requirements of business continuity, enabling quick recovery through joint planning, and coordinating communication both at the national and local level” (NCEMA, 2012). With the setting up of NCEMA, national, regional and local

operation centres were established to ensure the preparedness of all UAE organizations involved in crisis management through periodic training and exercises.

NCEMA set its goals and objectives as follows:

- To compose a unified federal emergency law governing the management of national emergencies and consequently develop a National Response Plan (NRP).
- To establish a national emergency command centre responsible for coordinating and managing all capabilities and resources on a national level.
- To establish a national crisis and emergency command and control as the executing arm for NCEMA responsible for managing national capabilities and resources and coordination between all parties.
- To ensure preparedness of all organizations involved in the management of emergency and crisis within the UAE by conducting periodic training and exercises.

Literature shows that the difference between standards are owed to a variety of features related to the countries such as geographical, social and political aspects (Nazarov, 2011), as well as levels of responsibility relating to emergency management, which follow the lines of their national system of government. As mentioned earlier, there are established standards applied in the four developed countries. However, the UAE is still in its infancy in the field of emergency management. The director general of NCEMA has recognized that whilst the UAE and the region has vast experience in the field of emergency and crisis management, there is a deficiency in terms of preparedness and poor coordination between those working in the field and in the lack of national plans. The UAE's lack of preparedness is certainly a cause for concern; it is an issue upon which other countries concentrate heavily – for example, the first four stages of the UK's emergency management system deals with this aspect alone, while Japan is known as the world leader in preparedness. As noted by Alexander, 2002: “.....we should all prepare for the next disaster as remarkably few of us will be able entirely to avoid it”.

Hence, the main aim of this paper is to create a conceptual emergency preparedness framework for the UAE. Therefore, the second part of the literature review will focus on the various models and frameworks which will lead to identifying the key elements effecting emergency preparedness.

3. Emergency Preparedness Models and Frameworks

As discussed earlier, each of the five countries has its own set of standards for emergency management, with some similarities but also some slight differentiation. No emergency management organization can function without a strong preparedness capability (Haddow et al, 2011). Since the aim of this research is to establish a conceptual framework of preparedness for the UAE, it will examine the various frameworks and models of preparedness applied in various countries such as the US, UK, Japan, Australia and UN. The aim is to contrast and compare them in order to identify the key elements effecting preparedness, leading to the establishment of a conceptual framework of preparedness for the UAE.

According to Pelfrey (2005), “the topic of preparedness is complex and depends on many of the sub-elements contained in definitions”. Certainly, in the US, where a

large part of the literature concerning emergency management emanates, most documents produced by academics and government agencies have not agreed on an explicit definition of “preparedness”. A broad definition was proposed by the Department of Homeland Security in 2004, suggesting that preparedness can be defined as ‘planning, training, equipping, exercising, evaluating, and taking action to correct and mitigate for future disasters’ (Pelfrey, 2005). Therefore, from this prospective, the task in hand will focus only on the preparedness steps that are required before a disaster occurs.

3.1 Pelfrey’s Model

According to Pelfrey (2005), “....a consensus strategic process of disaggregating preparedness into phases or elements to organize the preparedness process has not been articulated.” Based on that concern, however, Pelfrey suggested that the best way of understanding preparedness is to use a timeline or cycle. Hence, he makes a distinction between two different kinds of preparedness definitions. The first is the ‘preparedness cycle’ which relates to the steps, procedures, training and planning done to prepare before a disaster.

The second is referred to as the ‘Cycle of Preparedness’ which adopts a comprehensive approach and includes a number of different elements that happen before, during and after a disaster (Pelfrey, 2005). Pelfrey’s second definition – the Cycle of Preparedness – shown in figure 1 below, is more applicable to emergency management as a whole, since the cycle of EM appears clearly in his model. Therefore, this research will adopt the definition of the “preparedness cycle” in order to direct the research scope specifically on the elements of preparedness.

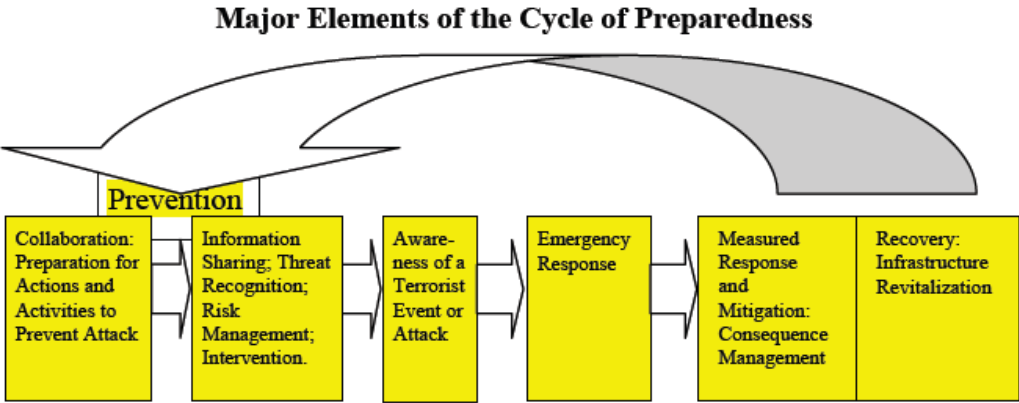


Figure 1: Elements of the Cycle of Preparedness
(Source: Pelfrey, 2005)

The model above shows four steps, starting with prevention, then early warning system, response, mitigation and recovery. Pelfrey’s model therefore provides a comprehensive approach which covers the entire cycle of emergency management of the elements shown above. Hence, this research will concern itself with only those which effect preparedness, and which are illustrated in table 2.

3.2 *United States (US) Model*

Another model has been adopted by the United States Federal Emergency Management Agency (FEMA) with emphasis only on the preparedness stage of EM (FEMA, 2012). The US faces a wide range of threats, not least that of terrorism, and employs various models and frameworks, with a model used specifically for preparedness, shown below in figure 2:

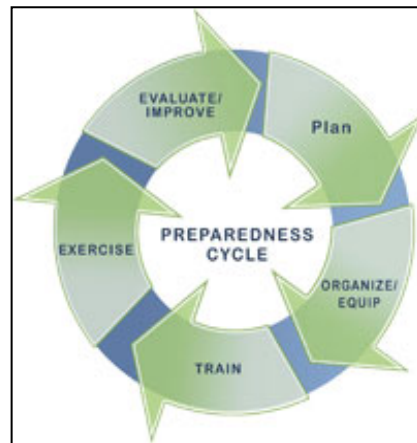


Figure 2: The Preparedness Cycle (Source: FEMA, 2012)

As illustrated above, the US model is a closed, ongoing process comprising five stages, starting with planning, moving to organizing, training, exercising and evaluation, then continuing the cycle again. This process echoes this study's definition of the preparedness cycle. Unlike Pelfrey's model, divided into before, during and after disaster stages, FEMA's model concentrates solely on the early stages of hazard, ie, before a disaster. In contrast to the Pelfrey model, its cyclical pattern emphasises the continual processes to be followed in order to achieve preparedness. Although it does not place preparedness in a wider context, this is something of an advantage for the purposes of this research. This model specifically relates to the early stages of emergency preparation, and will therefore be useful in identifying the key elements for the preparedness framework, as shown in table 2.

3.3 *United Nations (UN) Model*

In contrast to the US, which is a single country with a certain set of concerns, the UN is a broad organisation representing and responding to the needs of a diverse group of member countries. According to a resolution adopted in 1991, the UN's specific responsibility is to provide "preparation for, as well as rapid and well-coordinated response to complex humanitarian emergencies and sudden and natural disasters" (UNDP, 1994). As part of this mandate, the UN created its own disaster preparedness framework, shown in figure 3.

3.4 *Australian Model*

Australia faces a variety of natural hazards such as cyclones, bush fires and flooding (EMA, 2004). As Australia's approach to emergency management aims to be both 'comprehensive' and 'integrated' a broad approach is taken, taking in prevention, preparedness, response and recovery. Emergency Management Australia (EMA)

identifies typical activities for each stage. This study will take only the elements from the Preparedness stage, as illustrated below in figure 4.

In general, the Australian approach has similarities with Pelfrey's model which also covers the whole timeline for the emergency cycle. Again, as with Pelfrey, for the purposes of this study the key elements affecting only the preparedness stage will be isolated and adapted.

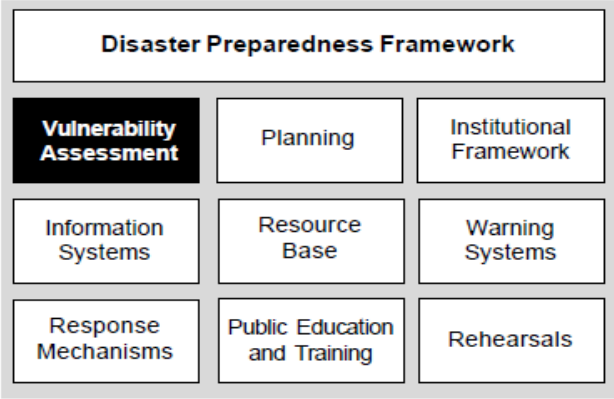


Figure 3: Disaster Preparedness Framework
(Source: United Nations Programme, 1994)

<i>Preparedness</i>		
Emergency response plans	Mutual aid agreements	Training programs
Warning systems	Public education	Test exercises
Evacuation plans	Public information	Refuge shelters
Emergency communications	Resource inventories	

Figure 4: Preparedness Elements of Australian Emergency Management
(Source: EMA, 2004)

3.5 Key Elements Affecting Preparedness

The key elements which effect preparedness have been identified from the various frameworks and models, and are shown in table 2. For the purpose of this study, only the common elements between these four standards, as shown above, will be selected. However, identifying the common elements between them can be problematic, since each country uses different terms for the same meaning. For instance, Pelfrey uses the term Preparation, FEMA uses the term Plan, UNDP uses the term Response Mechanism and Australia uses the term Evacuation Plans, which all actually mean Plan, similar to the US term. As a consequence, two approaches will be adopted here to avoid the similarity of terms between these countries. The first approach will choose all the elements of the US preparedness cycle as main elements, the reason for which is given below. The second approach will add the elements from other countries not covered by the US cycle.

Time	Before		During	After
Emergency Manageme nt cycle	Mitigation	Preparedness	Respond	Recover
		Preparation Activities Early warning system		Recover
According to Pelfrey (2005)	Measured Response MCM	Threat recognition Collaboration Info sharing Risk management Intervention Prevent	Response	Infrastructure
		Plan Train Exercise Organize/ Equip Evaluate		
		Planning Response mechanism Public education and training Warning System Rehearsal Institutional framework Resource Base Vulnerability assessment		Recovery stores Manage public appeals Restore public assets
Emergency Manageme nt Australia (2004)	Building codes Legislation Insurance	Emergency response plans Evacuation plans Refuge shelters Mutual aid agreements Training programs Public education Test exercises Warning systems Public information Emergency communications Resource inventories	Registration and tracing Evacuation Mobilise resources Damage assessment medical	

Table 2: Key Elements Affecting Preparedness

Why the US rather than the others?

- The elements of the US preparedness cycle appear in all countries but with different meanings, as seen above.
- In contrast to other countries, the US cycle is unique in considering the preparedness aspect alone, which supports our aim.
- The US has the most extensive literature on preparedness as well as significant experience in dealing with all type of hazards.
- Although the aim is to find the common elements which effect preparedness, without the approach mentioned above it would not be possible to find a complete cycle. In other words, if elements alone are chosen without the approach above there will be gaps in the preparedness cycle and the main aim of the study will not be supported.

Table 3: The final key elements which effect preparedness

No	Key Elements	Origin	The Definitions
1	Warning system	Pelfrey UN Australia	Early warning systems help to reduce economic losses and mitigate the number of injuries or deaths by providing information that allows individuals and communities to protect their lives and property. Early warning information empowers people to take action when disaster is close(UNEP)
2	Risk Management	Pelfrey UN	A subsection of overall emergency management, which focuses upon mitigation preparedness activities that prevent and/or reduce hazard impacts, and is widely considered to be its own discipline. (ICDRM, 2007)
3	Information system	Pelfrey Australia	The process of gathering, storing, analyzing, and disseminating data, information, and intelligence between and among different agencies, organizations, and individuals, on a need-to-know basis, for the common purpose of foreseeing or recognizing threats (Pelfrey, 2005)
4	Planning	US	Plans that address the preparedness of organizations for emergency response and recovery. (ICDRM, 2007)
5	Training	US	“Planned activities which support and improve individual and organizational performance and effectiveness, such as on-the-job training.... career development programs.” (Blanchard, 2008)
6	Exercise	US	Training for, practicing, and improve performance in prevention, protection, response, and recovery capabilities in a risk-free environment.” (Blanchard, 2008)
7	Organize	US	To provide the human and technical capital stock

	equip		necessary to build capabilities, address modernization and sustainability requirements (FEMA, 2012)
8	Evaluate	US	A systematic assessment process that leads to judgments and decisions about plans, programs or policies (adapted from Schalock, 2001), or. “informal” evaluation, as an ongoing activity.(ICDRM, 2007)
9	Public education	UN Australia	Standardized curricula for children and young adults should include information about actions to be taken in case of a disaster. (UNDP, 1994)

These key elements will be as a basis for my future work in doctoral research. They will be further tested in order to see whether they are comprehensive enough to form the basis for the strategic approach to emergency preparedness in the UAE and a mixed method will be adopted using a suitable approach to refine this framework.

4.0 Conclusion and Future Work

This paper has addressed international standards of emergency management, focusing on the world's most economically developed countries. Then it reviews emergency management standards in the United Arab Emirates (UAE). Finally, it explores the various frameworks and models of emergency preparedness aiming to identify the key elements which affect emergency preparedness in order to create a conceptual framework of preparedness for the UAE.

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Improvement of Healthcare Services in Low- and Middle-Income Countries through the development of a successful outsourcing plan

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Abstract

Traditionally, outsourcing in healthcare has primarily been driven by cost effectiveness objectives and a focus on core business strategies in order to improve the quality of services. However, in low-income countries different challenges necessitate a more comprehensive approach to improve the quality of care. The aim of this study was to reform healthcare system in low and middle-income countries (LMIC) through exploring outsourcing options and investigate management views of the impact of the outsourcing to improve of quality of care. A survey performed at major hospitals serving 2.5 million people in Taiz province in the Republic of Yemen. To identify services outsourced by hospitals and to determine the benefits of implementing outsourcing plan. The research indicated that the LMIC healthcare system would benefit from a contribution from NGOs in collaboration with government and other stakeholders. The healthcare systems in LMIC must incorporate different approaches in implementing outsourcing plan that address community training and education needs. The improvement of the healthcare setting in the low-income countries require strong partnership with all major stakeholders and technology providers to explore further beyond the traditional organizational boundary as the framework for analysis. LMIC Healthcare system reform is dependent on NGO collaboration with governments and key stakeholders.

Keywords

NGO, Healthcare, Low- and middle-income countries, Outsourcing, Yemen.

Introduction

The increased burden of disease in low- and middle-income countries (LMIC) cannot be overlooked, especially in the republic of Yemen where mortality and morbidity rates are currently high and likely to increase. In terms of burden of disease, measured in disability-adjusted life-years (DALYs), chronic diseases were responsible for an estimated 49% of the total worldwide burden of disease in 2005 and 46% of the disease burden in low-income and middle-income countries (Abegunde, Mathers, Adam, Ortegón, & Strong, 2007).

A number of changes are taking place in the epidemiological profiles of populations and the financing and organization of health systems that have increased the need to set health reform priorities. Health financing arrangements in middle-income countries vary widely by geographic region and cultural context. A variety of health

reform efforts with varying approaches are under way in this cluster of countries as well (“Financing health in middle-income countries,” World Bank. 2010).

Healthcare is a critical component of a country’s economy both from the national and local perspectives. Economic shifts in a country can result in changes in demand for healthcare and in the delivery of healthcare. Over the long term, as populations grow there is likely to be a growing demand for healthcare.

This will call for better integration and efficiency of services, and improved legislative reforms affecting the financing and regulation of healthcare and its effects on economic cycles. It is very important that policy makers in poor settings identify the key barriers to healthcare before embarking on expensive healthcare programmes, whose success relies on good existing health infrastructures (Lagarde & Palmer, 2009). Improvements in the economy and employment and the implementation of new regulations seemed to have contributed to the success. Continued macroeconomic stability plus further efforts to improve efficiency bode well for the system’s financial sustainability (“Financing health in middle-income countries,” World Bank.2010).

The paper has aim of explore outsourcing options to support the ongoing process of improving healthcare systems in LMIC, the implications of outsourcing, and the fundamental motivation for the selection of outsourcing options.

Methodology

The aim of this paper is to contribute to discussion around the development of a strategic framework for healthcare system reform in LMIC by using US\$280 million Hamad Medical City project (HMC) in Province of Taiz- Republic of Yemen based on contribution from the State of Qatar to Republic of Yemen aimed at both improving the healthcare system in Yemen and identifying success aspects for possible replicate the project in other LMIC.

The study focuses on the impact of outsourcing in the improvement of the quality of care of Taiz province that serves a population of 2.5 Million. Taken into consideration that sourcing decisions entail determination of the scale and criticality of organizational activities, motives, and the level of Involvement with the sourcing partner in a foreign country (Javalgi, Dixit, & Scherer, 2009).

Systematic review of published data and studies of healthcare performance and outsourcing options in low- and middle-income countries to investigate outsourcing options to improve healthcare services in LMIC countries. The research undertaken over three stages being:

1. Interview of senior management of 3 public and 2 private hospitals in Yemen and literature review that allow the design research questioners for next stages.
2. Interviews and electronic voting system to evaluate the response of 50 leaders from Three groups, The HMC project stakeholder represented by the project steering committee and project management team, the health authority and public hospital management been responsible for the healthcare delivery system and the last group which includes representation of private hospitals and selective venders. Questions focus on how HMC can strategically fit in the Taiz healthcare system and how it can best contribute with innovative solutions that result in the overall improvement of the healthcare system.

3. Evaluation of 27 Taiz public and private hospitals with a focus on how outsourcing could provide added value and what areas of outsourcing should be considered for the improvement of Taiz healthcare sector.

Results

The research results are summarized below according to the three stages of the research.

First Stage Results

Wide review with objective of gather information and examples from both published and grey literature that could demonstrate the full picture of the prime reasons, risks, benefit and trends found when outsourcing different activities in both high, Low and mid-income countries in order to understand the reality beyond the outsourcing processes and approaches. In order to describe and compare all the relevant findings of the literature review, a visit to different healthcare systems practices in LMIC countries such as Egypt, India to assist in expanding the selected senior Yemeni management interview with objectives of developing updated reality of outsourcing in healthcare in LMIC countries that allows the design research questioners for next stages.

Second Stage Results

Figure-1 shows that (95.56%) agreed on HMC should contribute to healthcare reform in Yemen with an immediate focus in Taiz.



Fig.1. HMC and Health Care Reform

As in Figure-2, three quarters (75.56 %) of the participants were of the opinion that healthcare financing in Yemen should be through a combination of applying a social insurance system, applying a cooperative community insurance system, and payment per capita to providers to cover 800,000 HMC target community.



Fig.2. Healthcare Financing in Yemen

Figure-3 below shows that (86.96 %) of the participants thought that HMC's role in health care should be to improve overall health care in the Taiz region (not to provide medical services only in the Medical City).



Fig.3. Hamad Medical City's Role in Healthcare

Figure-4 (89.13%) agreed on the model of care that HMC should adopt is a medical system model that provides comprehensive services to the community that includes primary, secondary and tertiary care services.

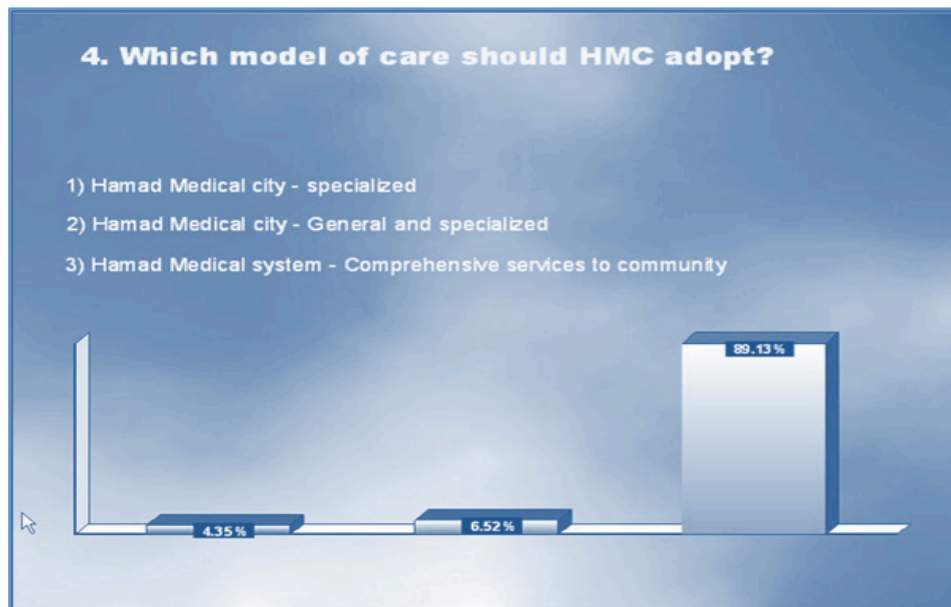


Fig.4. Hamad Medical City's Model of Care

In figure-5 (89.13%) were of the opinion that proper primary care in Taiz should be through a combination of upgrading the level of care in the current centers and establishing new state-of-the-art Primary Healthcare Centers.

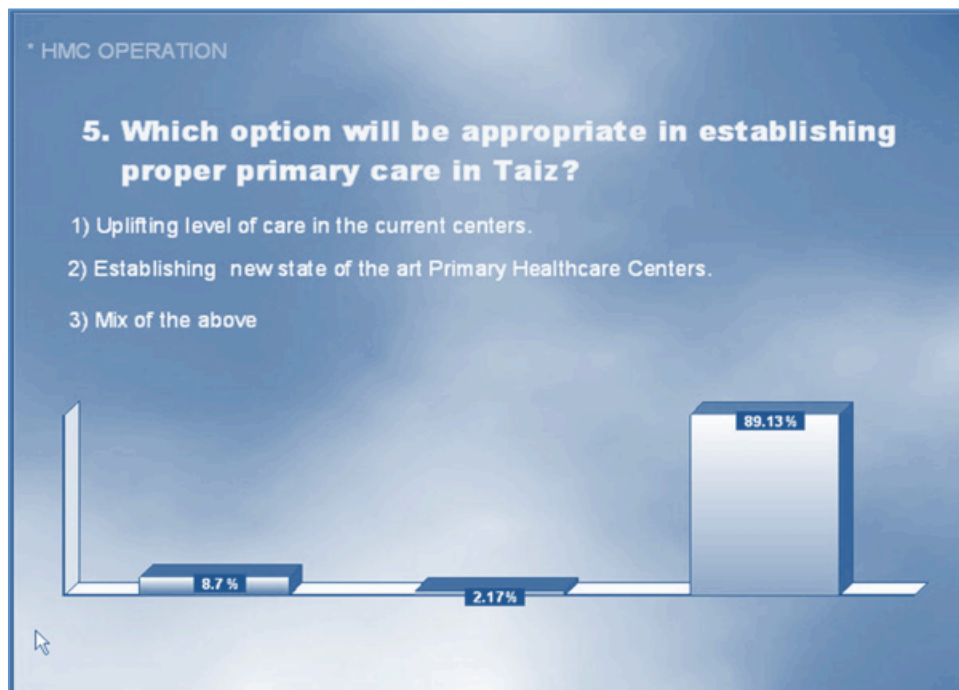


Fig.5. Primary Care in Taiz

As illustrated in Figure 6, the large majority (93.48 %) of the respondents thought that HMC's operation should be financed through a mix of out-of-pocket payments by patients, insurance system payments, and payments by charity organizations through capitation arrangements.



Fig.6. Financing Model for HMC's Operation

In figure-7 (93.33%) indicated that HMC should create added value business to support the community of Taiz and the Medical City (as opposed to concentrating on medical services only).



Fig.7. Creating Added Value

The vast majority (97.83 %) of the respondents thought that in order to ensure the quality of its services, HMC must affiliate with international centers, as shown in Figure-8.



Fig.8. Affiliation with International Centers

Third Stage Results

In this stage 100 distributed questionnaires to 27 Taiz public and private hospitals management with 85 responded. Table 1 addresses the main benefits that outsourcing could bring to the Health Sector in Yemen on priority basis for hospital services. The first priority address the need for improvement in Quality of health services (49%), the second priority consider the improvement in efficiency in the provision of health services (48%) that address the fact of lack of accountability in healthcare system, the third priority which emphasis on the improvement in Access to health activity with regards to provision, coverage and utilization services (42%).

Table 2 addresses the reasons that would drive the decision to outsource activities in organization adapted from (DELOITTE, 2005). The main reasons were cost savings (22%), access to best practices and leading technology/ innovation (19%), and improvement of the quality of the services (14%).

Table 3 looks into the capacity rating for handling the hospital services and what activities would of benefit from outsourcing based on two types of questions:

Questions that consider the added-value of outsourcing: (50%) considered Information technology a core/strategic function in my organization and should not be outsourced, however, we need support/technical assistance to strengthen the work capacity, this also (40%) see that the in-house capacity is not adequate and this function would definitely benefit from outsourcing. For Housekeeping (55%) and Laundry (66%) they believes that enough capacity to handle current requirements, however if they outsourced these functions it would allow the organization to focus

more on core/strategic functions. In the other hand feels that outsourcing may bring benefits to my organization in relation to Diagnostic imaging (70%), Laboratory to(65%) and equipment maintenance (85%) which although these services considered to be core/strategic function and should not be outsourced, however, they need support/technical assistance to strengthen our in-house capacity.

Table 1: Benefits from Outsourcing

The main benefits that outsourcing could bring to the Health Sector in Yemen	Priority One		Priority Two		Priority Three	
	No.	%	No.	%	No.	%
Improvement in Access to health services (provision, coverage and utilization)	15	18%	20	25%	22	42%
Improvement in Quality of health services	42	49%	5	6%	3	6%
Improvement in Equity in the provision of health services	10	12%	17	21%	11	21%
Improvement in Efficiency in the provision of health services	18	21%	38	48%	16	31%

Table 2: Reasons for Outsourcing

What reasons would drive the decision to outsource activities in your organization	Responses	%
Improve Quality of the Services	12	14%
Focus on Core and Strategic Functions	10	12%
Cost Savings	19	22%
Lack of Expertise In-House	8	9%
Access to Best Practices and Leading Technology / Innovation	16	19%
Access to High Caliber Labor	3	4%
Transfer Risk to Vendor	7	8%
Flexibility/Capacity/Scalability	10	12%
Total	85	100%

Questions that consider outsourcing of less value: Housekeeping (89%) and security (62%) assured that these services are already outsourced. As in the case of Pharmacy (62%), Human resources (53%) and Patient accounting (50%) considered that they have enough capacity to handle current requirements and any future growth in-house & outsourcing would NOT add any value.

Table-4 going over the Barriers/Challenges for outsourcing in Yemen (Sameen Siddiqi, 2006). As of (61%) found does not agree that the Central Government/Ministry of Health have policies in place for dealing with outsourcing and (69%) appreciate that the Central Government/Ministry of Health have policies in place for regulating the provision of services/technical assistance by NGO's. For the availability of enabling political environment for the execution of contractual arrangements response varies between (47%) do not know and (39%) agree on the readiness of the political environment for any outsourcing initiative. This with (55%) disagree that the political environment could influence the negotiation and execution of contracts and only and (32%) think the influence is quite limited. That raise the question of consideration of the legal framework in Yemen could facilitates contracting between the public and private sectors with majority of (61%) agree and still (29%) disagree with presence of transparency in the handling of tendering and contractual processes. In view of proper system in place (56%) expressed a negative experiences related to contractual issues and (66%) disagree of they ever encounter any positive experiences related to contractual issues.

Discussion

Research performed aims to explore the rationale for development of outsourcing solutions to resolve healthcare issues in LMIC's countries. Key questions include: How do healthcare organizations operate in Yemen? What are potential areas of improvement in the healthcare system?; What core and strategic activities should remain in-house?; and finally which services may benefit from outsourcing solutions? The questionnaires results will be used as a road map for further development of the HMC project and the clarification of its role in healthcare reform.

The improvement of the healthcare setting in the low-income countries requires strong partnerships with all major stakeholders and technology providers to further explore beyond the traditional organizational boundary as the framework for analysis. Moreover, in LMIC's countries access to innovative funding and investment vehicles plays a vital role in the continuity of services and social sustainability. It was confirmed that the most substantial risks are related to the need to develop new management competencies, capabilities and hybrid decision making process in how to integrate internal and external service relationship.

Contracting out of health services is receiving increased attention among low and middle-income countries however, while evidence relating to the benefits and risks of this approach is accumulating it is far from conclusive. Careful consideration and a thorough analysis of the local context are essential before deciding on outsourcing versus direct provision(Lagarde & Palmer, 2009).

Table 3: Potential Areas to be Considered for Outsourcing

Functional Area	House-keeping		Food Service		Laundry		Human Resources		Diagnostic Imaging		Pharmacy		Patient Accounting		Laboratory		Equipment Maintenance		Security		Information Management	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Options																						
Enough capacity to handle current requirements and future growth in-house & outsourcing would NOT add any value.	4	5	10	11	16	19	45	53			53	62	43	50					22	26		
This is considered a core/strategic function in my organization and should not be outsourced. We have adequate internal capacity and DON'T need any support/technical assistance to strengthen our in-house capacity							6	7	18	21	7	8	12	14	22	26	4	5				
This is considered a core/strategic function in my organization and should not be outsourced; however, we need support/technical assistance to strengthen our in-house capacity.							21	25	59	70	17	20	8	9	56	65	72	85			43	50
Enough capacity to handle current requirements, however if I outsourced this function it would allow my organization to focus more on our core/strategic functions. Outsourcing may bring benefits to my organization.			47	55	56	66	8	9			5	6	4	5	3	4			7	8		
In-house capacity is not adequate, this is not a core/strategic function in my organization and this function would definitely benefit from outsourcing.	5	6	7	8	2	2			6	7			15	18	4	5	7	8	3	4	34	40
Not applicable or I don't have enough knowledge to provide an opinion							5	6	2	2	3	4	3	4			2	2			4	5
Already outsourced in my organization.	76	89	22	26	11	16													53	62	4	5
Total No. of Responses	85		85		85		85		85		85		85		85		85		85		85	

Table 4: Barriers/Challenges for Outsourcing in Yemen

Barriers/Challenges for outsourcing in Yemen	Agree		Disagree		I Do Not Know		Total	
	No.	%	No.	%	No.	%	No.	%
Does the Central Government/Ministry of Health have policies in place for dealing with outsourcing?	16	19%	52	61%	17	20%	85	100%
Does the Central Government/Ministry of Health have policies in place for regulating the provision of services/technical assistance by NGO's?	59	69%	12	14%	14	16%	85	100%
Is there an enabling political environment for the execution of contractual arrangements	33	39%	12	14%	40	47%	85	100%
Does the political environment influence the negotiation and execution of contracts	27	32%	47	55%	11	13%	85	100%
Do you consider that the legal framework in Yemen facilitates contracting between the public and private sectors?	52	61%	25	29%	8	9%	85	100%
Do you consider that there is enough capacity among the public Health sector organizations for the monitoring and evaluation of contracts?	20	24%	47	55%	18	21%	85	100%
Do you consider that there is transparency in the handling of tendering and contractual processes	8	9%	62	73%	15	18%	85	100%
Have you had any negative experiences related to contractual issues	48	56%	11	13%	26	31%	85	100%
Have you had any positive experiences related to contractual issues?	8	9%	56	66%	21	25%	85	100%

The research display health systems in LMIC need to incorporate innovative approaches that include outsourcing options that will allow them to deliver comprehensive solutions to address the rising mortality and morbidity rates. In contrast to traditional outsourcing, in developed world more strategic functions were now being outsourced and thus arms-length management of the relations became insufficient. As a result, firms started building closer relationships with their vendors. Organizations stretched their boundaries to gain competitive advantage through outsourcing (Hätönen & Eriksson, 2009). But in case of Yemen with a political stability and security is an issue this prevent to create good business environment to encourage vendor client relationship that put a burden into NGO's like HMC to create a joint venture that bring local and international partners to manage technology driven services i.e. Diagnostic imaging and laboratory that will allow HMC other public hospital benefit from.

From the research it was understood that HMC in order to develop innovative outsourcing plan in LMIC healthcare system must ensure address the community training and education needs to maintain required resources. Although there are several advantages to the outsourcing, there are many barriers to outsourcing in the healthcare. If the fundamental infrastructures of outsourcing, including education, determining the appropriate goal, uses of entrepreneurs' managers, and so on are not reformed, the main goal of outsourcing in the health sector (cost reduction, increasing quality, efficiency, and effectiveness) is not achieved (Agharahimi, Karimi, & Yaghoubi, 2012).

HMC and Health Care Reform

The Government will need to take the lead on Health Care Reform in both Taiz and Yemen in general. HMC will coordinate with the Authorities and provide assistance as deemed feasible and as needed. Further research will focus on those aspects of reform that will help in the delivery of healthcare services and have an impact on Hamad Medical City. This why aspects to be analyzed with special attention and in coordination with the relevant Authorities in Taiz include resource mobilization and allocation and distribution of resources, which will undoubtedly have an impact on both HMC and Health Care Reform in Taiz. Supporters of contracting out also believe that a contract allows the government to shift its role from the provision of health care to tasks that may better reflect its core strengths, such as financing health care and monitoring provider performance (Liu, Hotchkiss, Bose, Bitran, & Giedion, 2004).

Healthcare Financing in Yemen

Out-of-pocket payments represent close to 70% of total health expenditure in Yemen and total Government health related expenditure per capita does not exceed USD 133 per year (WHO, 2010). Yemen needs to find ways to reduce the high risk of catastrophic out-of-pocket payments and explore alternatives for financing Universal Health Coverage. Financing of Universal Health Coverage could include a combination of insurance and capitation. Social insurance alone won't be enough given the large population living in rural areas who may be farmers or self-employed. Community-based health care financing alternatives need to be assessed, as a means of ensuring that all people are covered, especially the poor. The establishment of a Health Care Fund could support the above insurance and capitation components.

Hamad Medical City's Role in Healthcare and the Creation of Added Value

In order to have a larger impact by helping to improve overall health care in the Taiz region, HMC will focus its efforts and resources in the following strategic areas:

- Providing best quality healthcare services
- Promoting the development of human resources for healthcare
- Promoting the improvement and development of healthcare related industry

Hamad Medical City's Model of Care (Including Potential Affiliation with International Centers)

In line with the above strategic areas, the HMC project plans to include Medical Facilities, a Technology Park, and Academic and Research Facilities.

The HMC project contemplates developing its Medical Facilities in three phases. Phase one will include 200 beds of Cardiology and Cancer specialized centers, 100 General hospitals, and 100 beds of Ambulatory care services that linked with Primary Health Care centers that serve a population of 800,000 community.

The Technology Park's goal would be both to support the operation of HMC's medical facilities and to introduce the technology required by other health care providers in the Taiz region. Given the potentially very high costs, a health care fund could be created to allow many investors to share in the fund. Financing by international financing organizations may need to be considered.

Projects to be developed within the Technology Park will be based on feasibility studies, risk analysis and an assessment of potential partnerships where required. These projects may include:

- Chain of laboratory services: State of the art laboratory services aimed at providing accurate diagnostic tests based on high quality equipment, well trained professionals, information technology and telemedicine and at an affordable cost. The idea would be to start with one laboratory and expand into a chain.
- Radiology Center: The development of a chain of radiology centers could potentially have a very positive impact on Yemen Health Care. The feasibility of using Teleradiology needs to be evaluated. There may be lessons to be learned from similar experiences in Egypt and India.
- Medical Gases Project: Medical Gases are available only in Sana'a and Aden. The aggregate demand of Taiz governorate and those governorates close to Taiz needs to be assessed.
- Vacutubes Systems: Tubes used in labs are consumed in millions. All tubes in Yemen are imported. There is a big demand that will need to be assessed against the costs of developing and implementing this initiative.
- Pharmaceutical Industry: There are few drug production facilities in Yemen that do not cover more than 15% of the market requirements. This Project has a higher risk and would need careful planning.
- Medical Supplies Facility: To address the complaints regarding the unavailability of some medical supplies, help to improve health care and generate income.

The development of Academic and Research facilities would address the major gap in Yemen's health care sector between current human resources and projected needs. Shortages of adequately skilled health workers, particularly in rural areas, and lack of investment in training (Robinson & Hort, 2012). In Yemen the challenge is greater since high quality education and training are limited. Priorities in both the Academic and Research fields will need to be clarified, operational model alternatives will need to be defined, and partnering alternatives with national and international organizations will need to be assessed.

- Academic Centers could potentially include a Nursing College, a Public Health School, and a Biomedical Engineering Center.
- Yemen has a high incidence of infectious diseases. A Research Center located in Yemen could have important health impacts not only at the national level but also the international level.
- Financing Model for HMC's Operation

HMC's operational budget will depend on its model of operation. HMC's operation will probably be financed through a mix of out-of-pocket payments by patients, insurance system payments, and payments by charity organizations through capitation arrangements. Figure 9 below illustrates a mixed capitation and case based system where Primary Care and Secondary Care are covered by capitation and Tertiary Care is covered by case-based payment.

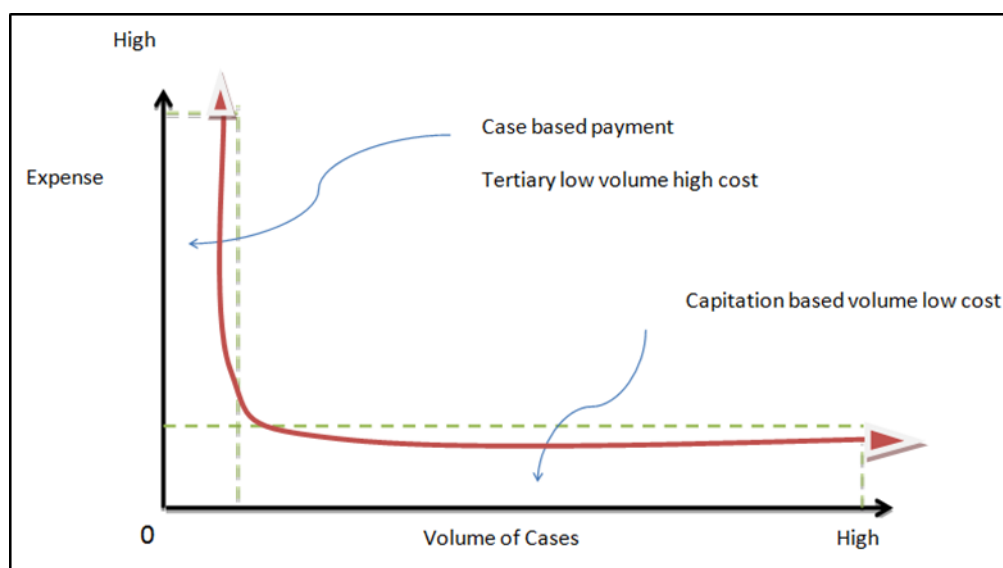


Fig.9. Mixed Capitation and Case-Based System

Financing requirements will also vary depending on the phase of development of the project. Table 5 below shows the potential components by phase according to which the financing model will need to be developed. Further analysis will be required to determine the best financing model for HMC's operation.

Table 5: HMC's Project Components by Phase

<i>Phase I</i>	<ul style="list-style-type: none"> • <i>Community Center</i> • <i>Laboratory</i> • <i>Radiology Center</i>
<i>Phase II</i>	<ul style="list-style-type: none"> • <i>Academic Center</i> • <i>Medical Facility Operation of 100 beds</i>
<i>Phase III</i>	<ul style="list-style-type: none"> • <i>Operation of the Full Facility</i>

Conclusion

This study suggesting more innovative approaches need to be considered in implementation of outsourcing strategy for the improvement of healthcare system in LMIC's countries. Also to outsource it is necessary to first build an appropriate team of experts to drive the outsourcing process (Lyles, 2010). The survey results indicate that if outsourcing been addressed properly hospitals may consider outsource some of their core/strategic functions, because they believe it will enhance the technical support needed for the in-house capacity.

It was also evidenced that if NGO's like in the case of HMC need to contribute in the overall healthcare system improvement must collaborate with government and other stakeholders to act as major player in all aspect of health reform strategy. The involvement of a wider group of non-government agencies and individuals can enhance the enforcement of regulation (Ensor & Weinzierl, 2007). With keep in mind the importance to reform the laws and regulations and to design an appropriate model according to health system structure.

Policymakers should focus on developing the education programs, modifying the management attitude and approach and apply incentive policies for moving toward outsourcing in healthcare(Agharahimi et al., 2012). This require partnership with local and international players to establish centralized advance service i.e. Radiology, Laboratory, equipment maintenance..etc. to create immediate impact on the improvement of healthcare system

The research indicate an important measures in mind such as the consideration of stage implementation for any initiative in LMIC's to allow policy in place , training and education to been the core of the plan to help capacity building and achieve desire care. With importance to develop new management competencies and the ability of decision making process in how to integrate internal and external service relationship.

Health systems in most LMIC, however, are largely weak, with shortcomings in governance, financing, human resources, health information systems and supply and availability of drugs and technologies. Consequently, this paper has argued that health systems in LMIC need to be reformed in order to deliver comprehensive approaches that will halt and reverse the rising mortality and morbidity rates(Robinson & Hort, 2012). Whilst numerous studies in developed countries proven the success of implementation of outsourcing in healthcare system. However, the limitation of this study in the case of LMIC's and in particular in Yemen more in-depth research need to be done in the fundamental infrastructure of outsourcing that includes training, deciding the appropriate goal, develop the right management team and most important

acquire adequate resource where the political stability and security is a major issue effecting the continuity of care.

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Development of a Collaboration Framework for Construction SMEs Based on a Cloud Computing Platform

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Abstract

About 98.2% of the construction sector includes businesses that are defined within SME (Small and Medium Sized Enterprises) category. Therefore, it is an essential part of the construction sector that requires attention. A massive part of their business depends on collaboration and partnering with other businesses. Cloud Computing is the latest trend to outsource some or complete IT operations to run a business from the public Cloud that provides a flexible and highly scalable technology platform for an organisation's business operations. It lowers IT costs and provides organisations with the people and expertise to create a "pre-integrated suite" of software applications. The technology would improve the collaboration methods within Construction SMEs and make them more competitive in the marketplace by minimising the cost of their hardware and software systems, providing them with greater security and accessibility and helping them to concentrate better towards their core business and enhance their productivity.

Keywords

Cloud Computing, Collaboration, Construction Industry, SMEs

1 Introduction

The aim of the research is to develop a collaboration framework for Construction SMEs based on a Cloud Computing platform. In examining the issue, the areas that come into sight include the importance of SMEs (Small and Medium Sized Enterprises) in Construction Industry and the significance of collaboration between them and why cloud computing technology is important to facilitate the collaboration in Construction Industry.

In recent years there has been a considerable increase in usage of ICT in the industry (Adair, 2006). The introduction of ICT has allowed the collaborative working to become part of the industry's daily practices. With the requirement to show the difficulties of introducing collaborative working into activities already described as being important to the future success of the industry, this paper aims to show how a more strategic approach to use ICT systems for collaboration between construction SMEs is achievable through the latest development of cloud computing.

Cloud Computing is simply a new term to describe the advantages of using computing as a utility. It has the ability to transform a huge part of the IT industry, making software even more accessible as a service (Armbrust, M., Fox, A., Griffith, R.,

Joseph, A.D., Katz, R.H., Konwinski, A., Lee, G., Patterson, D.A, Rabkin, A., Stocia, I. and Zaharia, M, 2009). Developers with innovative ideas for new Internet services no longer require the massive investments in hardware to set up their service or the human costs to operate it. They do not need to worry about over-provisioning for a service whose popularity does not match their predictions, therefore wasting costly resources, or under-provisioning for one that becomes hugely popular, hence missing potential customers and profits.

Whatever the cause of obvious resistance to an industry strategy of continual improvement, it is nevertheless commonly observed that SMEs are likely to expand the industry trend and be less technically innovative than large enterprises (Abbott et al., 2006). Although a widespread amount of literature exists on the subject of innovation delivery by construction companies, it tends to concentrate on big businesses, and the experience of SMEs in this area has gone largely unreported. While there are some notable exceptions (Abbott et al., 2006; Manley, 2006; Manley, 2008a), a major gap has been identified in the literature on the SME innovation delivery experience.

Research is needed to help Construction SMEs appreciate and understand the influence of using Cloud Computing Technology on the outcome of their activities and would have a positive result on their deliverable work and this research study will contribute to meet this need by developing a collaboration framework for Construction SMEs.

The research objectives can be defined as follows:

- To examine the features of cloud computing and its potential benefits to collaboration working.
- To identify the current collaboration issues occurred within the Construction Industry.
- To examine the key requirements pertaining to effective collaboration within Construction SMEs.
- To develop a collaboration framework for Construction SMEs based on a Cloud Computing platform.
- To validate the collaboration framework through expert workshops.

2 Literature Review

2.1 Cloud Computing

Today's internet, built upon ubiquitous connectivity, low-cost processing capacity, open standards and loosely coupled information technology (IT) infrastructure, has been widely recognized as a tremendous enabler for business collaboration (Chen et al., 2007). In the global marketplace, the internet is a tool by which businesses may uncover additional opportunities and is viewed as a requirement to develop a technology-driven competitive advantage (Liu and Orban, 2008). The internet-based cloud computing model, while intangible in context, offers a means by which technologically savvy organizations may leverage previously unavailable tangible IT capacity for a fraction of the traditional resource commitment. Synthesizing from several sources, cloud computing may be defined as a connectivity-facilitated virtualized resource (e.g. software, infrastructure, or platforms) that is dynamically reconfigurable to support various degrees of organizational need, which allows for

optimized systems utilization (IBM, 2009; IBM Global Technology Services, 2010; Vaquero et al., 2008).

Cloud computing is the latest trend to outsource some or complete IT operations to run a business from the public Cloud that provides a flexible and highly scalable technology platform for an organization's business operations (Armbrust et al., 2010; Badger et al., 2011; Catteddu and Hogben, 2009). It lowers IT costs and provides organizations with the people and expertise to create a "pre-integrated suite" of software applications. Various analysts' reports predict billions of dollars in revenue from Cloud computing (Gartner Press Release, 2010; Reuters, 2011).

Cloud Computing has many advantages as Nuria Lloret Romero (2012) point out these include:

- Cost reduction. Ability to increase or decrease the consumption of hardware or software resources immediately and in some cases automatically.
- Scalability. "Pay as you go" allowing a more efficient control of expenditures.
- Lower investment, reduced risk. Immediate access to the improvements in the resource proposed (hardware and software) and debugging.
- Support included. Enjoyment of the most advanced security procedures, availability and performance of providers with experience and knowledge in this type of service.
- Greater security and accessibility. Access to resources from any geographical point and the ability to test and evaluate resources at no cost.

Nuria Lloret Romero (2012) argues that the drawbacks are actually the same as those encountered by institutions that have information hosted outside of the entity. Whereas, in the case of hard-copy document files and at the enterprise level, this fear disappeared years ago, given the benefits of cost reduction in infrastructure management and security, in the case of digital data there is still a huge fear of putting our information in the hands of third parties. This fear arises due to issues such as confidentiality, theft, loss etc. Yet people are increasingly more likely to do so now that the use of Web 2.0 and social networks has become so widespread. There is nothing more sensitive than banking or personal data, yet this data is stored in servers over which we have no domain or ownership.

An institution might take the decision to progressively move towards Cloud Computing by uploading applications which are not very sensitive such as: messaging, the booking of rooms, meeting management, the liquidation of costs, and holiday management. Following this learning process, more valuable information involving the corpus of the institution, i.e. "Business intelligence" might be uploaded to the cloud.

By accessing services through the cloud, the elements related to their business could be bought on a pay-and-go basis, without the requirement to purchase whole ERP, finance or CRM sets (Sharif, A.M. 2010). Instead there will be a joint process from software and hardware sellers, and a relationship is then started directly with the middle-man: the cloud computing provider.

Cloud computing will be adopted by firms that are likely to use a more hybrid process of on-premise, "public" cloud and "private" cloud services when appropriate (Goscinski and Brock, 2010). The concept of private cloud computing involves firms

deploying key enabling technologies, such as virtualisation and multi-tenant applications, to create their own private cloud database. Individual business units then pay the IT department for using industrialised or standardised services in line with agreed chargeback mechanisms. For many firms, this approach is less threatening than an overall move to the public cloud and should make it easier to hand individual services over to trade partner providers in future (Tuncay, 2010). Moreover, cloud computing is a new business model wrapped around new technologies, such as virtualisation, applications (Software as a Service (SaaS)), platform (Platform as a Service (PaaS)), and hardware (Infrastructure as a Service (IaaS)) (Goscinski and Brock, 2010).

Everything as a Service (XaaS or EaaS) is a critical perception for cloud computing to implement its key enabling technologies (fast wide-area network; powerful, inexpensive server and high-performance virtualization). XaaS targets to make the available resources consumable so that it could help businesses take advantage of cloud computing. Cloud-oriented Service Solutions could play an important part in transforming enterprise systems, contributing to cost reduction, agile deployment of services, expanded flexibility and improved productivity. (The Customize windows blog, by Abhishek, 2011)

This XaaS principle can also be extended to the Business level (Business as a Service (BaaS)). IBM Global Business Services explained: “BaaS provides six key enablers (Speed and adaptability; Scalability/ elasticity; Cost flexibility; Analytics; Focus/ strategic alignment and Collaboration) that can fundamentally change an industry or expand the horizon of what is possible in business model innovation” (IBM Global Business Services Datasheet, 2011).

2.2 Construction Industry

Akintoye and Main (2007) state that in UK Construction Industry, have a positive perspective about collaboration and are involved in collaboration relationships for construction developments. According to their research study, factor analysis shows that the principal reasons why contractors are engaged in collaborative relationships are for risk sharing, access to innovation and technology, response to market, resource efficiency and client requirements. The major success elements are commitment of sufficient resources from the partners, equity of relationship, identification of the significance of non-financial benefits and clarity of objectives while the main failure aspects are lack of trust and consolation as well as lack of business experience (Akintoye and Main, 2007).

2.3 Small and Medium Sized Enterprises (SMEs)

SME is the known abbreviation for Small and Medium Sized Enterprises. Most of the workforce is employed by SMEs. Statistics for 2008 published by the BIS (previously BERR) Small Business Service (SBS) Statistics Unit show that out of 4.8 million businesses in the UK, 99.9% were SMEs. In the UK, sections 382 and 465 of the Companies Act 2006 define a SME for the purpose of accounting requirements. According to this a small company is one that has a turnover of not more than £6.5 million, a balance sheet total of not more than £3.26 million and not more than 50 employees. A medium-sized company has a turnover of not more than £25.9 million, a balance sheet total of not more than £12.9 million and not more than 250 employees.

About 98.2% of the construction sector includes businesses that are defined within this SME category (Construction Statistics Annual, 2007). Therefore, it is an essential part of construction sector that requires attention. A massive part of their business depends on collaboration and partnering with other businesses. How successful or not the collaboration is, would depend on the collaborative arrangements between the companies. These arrangements should be able to resolve the issues associated with such collaboration by allowing partners to expand resource and provide quick and flexible access to external resources.

Research has proven that some SMEs take advantage from cooperation for their innovation processes while others experience substantial issues. The positive effects include increased turnover, higher profit rates, and expansion of the product range (De Jong and Vermeulen, 2006).

However, SMEs often find it difficult to create and take advantage of inter-organisational innovation projects. One of the reasons is that smaller companies cannot enforce their determination upon others (Batterink et al., 2010). The sharing of the results is therefore a major issue for them. In addition, typically for SMEs, knowledge may accidentally spill over to other organisations. Finally, inter-organisational innovation projects may involve organisations with various cultural backgrounds, consequently leading to coordination problems. These normally increase proportionally to the number and diversity of the organisations involved. Hence, it is vital for a hub firm, especially an SME, to be well informed of the potential drawbacks of cooperation within networks, so as to mitigate these via suitable coordination mechanisms. In their study of 164 Austrian SMEs, Hoffmann and Schlosser (2001) showed that coordination (such as a precise definition of rights and duties) is a key success factor of cooperative arrangements. However, SMEs often lack the capacity to fulfil such key success factors for successful coordination and network management (Hoffmann and Schlosser, 2001).

Currently a cloud computing based innovation for collaboration within SMEs could be a major innovation to increase productivity. The reason Cloud Computing Based innovation for collaboration is recommended is because all different SMEs can contribute regardless of what operating systems they use. Everything will be based on a Cloud Computing platform accessible from any operating systems without requirements to use various programming languages for editing and sharing knowledge.

3 Methodology

3.1 Case Study

The case study approach is a research strategy involving an empirical investigation of a contemporary phenomenon within its real life context using multiple sources of evidence, and is especially valuable when the boundaries between phenomenon and context are blurred (Yin, 2009). It is widely used in research fields such as organisational and management studies.

Case study research is a very useful method as it allows expanding and generalising theories by combining the existing theoretical knowledge with new empirical insights

(Yin, 2009). This is especially important in studying topics that have not attracted much previous research attention. There are a number of different reasons why case study approach is chosen for my research. Firstly organisational experience is influenced by contextual factors that must themselves become part of the focus of the inquiry (Gilson et al. 2011).

SME workers' motivations are influenced by a range of personal and organisational factors as well as relationships with others and many features of construction industry within SMEs are influenced by the motivation of their workers. It is important to study those case scenarios and see how different cultures could adjust to adaptation of such technology and whether or not, it would have a long term positive result within the SMEs.

Furthermore, although there have been other collaboration and communication methods used within SMEs, it is important to introduce the collaboration method via the modern cloud computing technology which would not only minimise the cost of their systems but it would also increase their focus towards their business.

3.1.1 Interviews

I will use efficient and in-depth interviewing within two different Construction SMEs as my initial method of data collection for this research. According to Seidman's (2006) model, each participant will be interviewed three times. In order to provide context for understanding the participant's viewpoint, the first interview in Seidman's model (2006) focuses on the person's life history. I will focus on the participant's life in their enterprise, particularly with the perception of the past projects that they have taken on. The second interview focuses on the concrete details of the participant's present area of study in a topic area upon which their opinions may be built (Seidman, 2006).

In this interview, I will ask participants to describe their lives and the impact of their current projects. In the third and final interview, participants are asked to reflect on the meaning of their experience (Seidman, 2006). In this interview I will ask the participants, how this collaboration model would support their project activities and make a difference to their experiences compared to when they didn't have such facility in place.

3.1.2 Questionnaires

Within the case studies, some of the questions asked from the participants would include their attitude towards the existing communications methods within their SME and how using a web based collaboration model could improve their activities and increase the level of efficiency and effectiveness of their products and services.

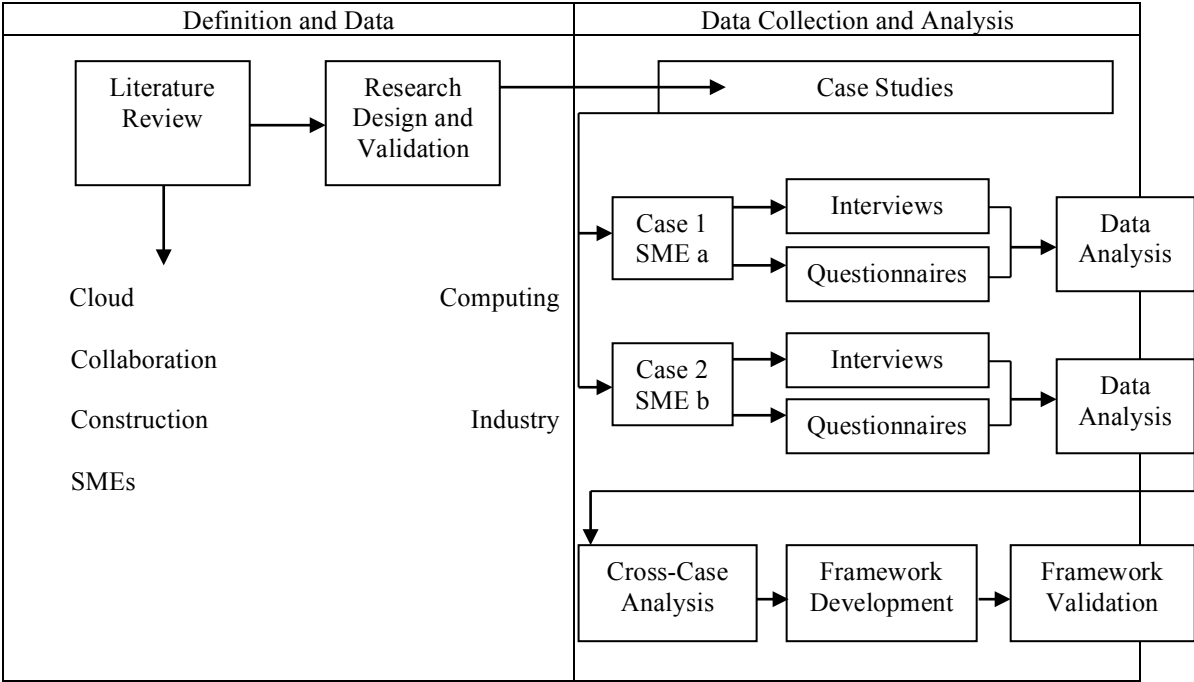
3.1.3 Data Analysis

I will return first to an analysis of interviews from individual participants, as separate cases, and only then consider the wider matter of cross-case analysis. Glaser and Strauss (1999) have argued that an understanding of individual cases (before they are aggregated in any way) is the best guarantor for the theoretical assertions that are grounded in specific context and real-world matters.

Next, I will read across interviews to note similarities and differences. I will then use pattern-coding (Miles & Huberman, 1994) to identify common thoughts and opinions. Finally, I will prepare the data analysis by briefly describing each of the participants and by using quotes from the interviews, will show common ideas and thoughts as well as different and unusual responses.

Data analysis will take place from the data collected by carrying out interviews and questionnaires within various construction SMEs. The research plan diagram is shown as follows:

Table 1: Research Plan Diagram



4 Findings and Discussions

4.1 Typical Case Scenarios

Case 1) Design Stage of a construction project: A typical architect has to collaborate with engineers such as mechanical and electrical engineers. The architect does the initial design, collaborates with the client and then passes that onto M & E engineers for the technical design.

Outlined Design → Detailed Design → Production Design

Client (i.e. a supermarket building) would give the requirements to the architect who then proposes different options for the client by collaborating with the structure engineers as well as M & E engineers in parallel.

Structure and M & E engineers will then form the design options and then send them to the client for their feedback.

The collaboration methods in such case scenario are currently using emails as well as file sharing servers to share large files.

Current drawbacks:

It would take a long time for the people involved in this project to make required changes to the original document, edit accordingly and again having to share using email or file sharing websites. Very time consuming and not user friendly options.

Possible Solution:

By implementing and adopting the Cloud Based Framework within their organisation, everyone can contribute towards their ideas and changes they wish to make without having to download or upload materials at various times using email or file sharing servers and they would not have to use any additional applications to update or edit the notes regarding the existing design.

Case 2) Contractor Claim Process: After finalisation of the design by the design team including architects, structure, Mechanical & Electrical engineers, a contractor is chosen, and as soon as the contract is confirmed, the building work starts. However, later on there might be some additional change requirements to the original contract. (i.e. design changes), so the process will involve the architect instructing the contractor to the changes required based on decisions of the client as well as the M & E team. The contractor will check the changes against the original design and consults the sub-contractors to find out the impacts made on costs and time based on new change requirements. The contractor will then provide an estimate for the new changes back to the architect for them to consult this with the client and the design team including quality surveyor, before finalising a decision. This case scenario would typically involve negotiations regarding the new price and also new deadline for delivering the project.

Current drawbacks:

Tools are used to identify the changes, provide measurements and estimate costs but as they are not web based, it will be quite time consuming and difficult to use for some people involved in the collaboration who have little knowledge of how to edit the changes and resend it back to the others.

Possible Solution:

By implementing and adopting the Cloud Based Framework within their organisation, people will not require a separate access to measurement tools and having to install them on their Personal Computers. They will save an enormous amount of time and effort by simply requiring nothing other than an Internet Connection to access the framework for the necessary measurements and the ultimate cost estimations. Basically the only requirements would be either a Desktop or a Mobile Device as well as an Internet Connection.

5 Conclusion and future work

The ability to collaborate by sharing knowledge and resources is a major factor for long term improvements of Construction SMEs and Cloud Computing Technology is one of the key solutions for developing a collaboration model which would ultimately increase the knowledge and resources of various companies by enabling them to collaborate on a web-based platform from anywhere by simply using a desktop/mobile device and an internet connection without having to worry about the costs of running the system if their materials keep growing. Although it will require the workforce adaptation to the technology but it could be classified as a long term solution for ultimate effectiveness and efficiency of various tasks delivered within Construction SMEs.

The implementation of a collaboration model based on a cloud-computing platform will increase productivity within Construction SMEs as well as minimising their system costs and allowing them to focus mainly on their core business.

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People, Skills and Education

Factors affecting stakeholder satisfaction in built environment higher education in England

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Abstract

Significant changes within the higher education sector in England are anticipated as a result of policy changes relating to higher education introduced in September 2012 following the government's acceptance of the recommendations by Lord Browne published in the Independent Review of Higher Education Funding and Student Finance. The Higher Education sector in England faces a huge task to meet the expectations of students due to the identified changes in policy. The aim of this paper is to review the impact of the continuing policy changes on the provision of higher education in England in order to better understand the interrelationship between the differing stakeholders within higher education and how this impacts on satisfaction rates. The key objectives are to a) Identify key stakeholders within built environment higher education and the measures of stakeholder satisfaction, and b) Assess the impact of policy changes within higher education on stakeholder expectations and satisfaction rates. The research methodology included a literature review and semi-structured interviews seeking qualitative data. The findings of the research indicates that the ability of an institution to meet student expectations in terms of quality of the student experience and employability and as represented in key measures of satisfaction such as NSS and league tables, are central to the continued supply chain of students into universities and industry, and therefore ensuring stakeholder satisfaction for all stakeholder groups.

Keywords

Education management, Higher education, student experience.

1. Introduction

Government policy in relation to higher education in England has developed over many years to ensure economic and social objectives are met. The role that funding of higher education plays in delivering the stated policy is critical to understanding the policy developments within the sector. The needs of industry and issues of employability are also important in understanding stakeholder expectations and satisfaction levels. The influence of technological and industrial developments and the need to service industry with a workforce which is educated and skilled opens up issues of employability for those who participate in higher education. Barnett (1994) concludes that '*academic competence is being displaced with operation competence*'. Built environment higher education programmes of study have been developed to meet the needs of the individual professions in relation to the knowledge and skills

required to deliver competence within the workforce whilst conforming to the nature and purpose of higher education.

The influence of external factors on discipline areas should not be forgotten in terms of how they shape knowledge development. Government policies in relation to higher education, social expectations and cultural changes all have an impact on the priorities for knowledge development/production. Changes in educational policy for example, have led to significant changes in the ability of people to access education, the range of subjects offered by universities and the increasing need for education to operate as a successful business. The changes to education policy towards greater access to education and inclusivity have also lead to significant pressures on higher education providers to meet the demands of those who wish to participate in higher education while adapting to the changing funding and regulatory changes imposed by government.

With the introduction of significant changes to the regulatory framework and funding arrangements introduced in September 2012 coupled with the resultant expected fall in student numbers it is crucial for institutions to be as attractive to students as possible. In order to successfully compete within the new market conditions, institutions will need to be able to demonstrate that they provide a high quality education, which meets the expectations of students and other interested stakeholders. The context for the study is built environment undergraduate degree programmes including Architecture, Surveying and Construction Project Management undergraduate degrees. Understanding the individual stakeholder groups and their expectations will provide the basis for development of a strategy to ensure institutions can meet those requirements and ultimately be competitive within the market.

The ability of the industry to attract graduates who need to invest substantial sums of money on their education will be key in terms of the continued success of the construction industry in the UK and overseas. Employment prospects, salaries and career progression will be considered by prospective students when making a degree choice. The professional bodies will be keen to maintain standards of entry to the profession and ensuring membership levels are maintained. The impact of possible changes to the number of entrants to the professions will be of strategic interest to the professional bodies and the industry.

The aim of the research is to identify the key drivers for delivering satisfaction to the identified stakeholder groups within the built environment higher education sector. To achieve this aim the following objectives will be addressed;

1. Review government policy development in relation to higher education.
2. Identify key stakeholders within built environment higher education.
3. Identify key measures of stakeholder satisfaction.
4. Assess the impact of policy changes within higher education on stakeholder expectations and satisfaction rates.

2. Literature Review

Since World War II, equality of educational opportunity has been the foundation of social and political debate. The debate was originally linked to concepts of individual and social mobility but increasingly also became associated with social class or with people from disadvantaged family backgrounds. The 1944 Education Act began the

process of widening access to education through changes related to secondary education in an attempt to provide some measure of educational equality. The UK governments' attempts to expand access to higher education correspond to three key policy 'moments' (Trow, 2005) which has substantially changed the scale and scope of the higher education enterprise. The development of the changes in policy specifically relating to the funding of higher education can be traced back to the Robbins Report (1963). Robbins (1963) asserted that higher education should fulfill the following purposes a) instruction in learning; b) promotion of general powers of the mind; c) the advancement of learning; d) the transmission of a common culture. It was in evidence to the Robbins Report that the idea of a student loans system with income-contingent repayments was raised in the UK context (Barr and Crawford, 2005). In 1966, Secretary of State Anthony Crosland introduced a binary policy creating a 'distinctive' higher education sector within the local authority system. Many of the new polytechnics were formed during the expansion of higher education in 1960's in response to the increased demand for technical education. This led to a rapid expansion of institutions providing access to higher education courses and as a result a larger proportion of the population had the opportunity to benefit from higher education. Watson (2006) suggests that the on-going policy to widen participation is linked to social justice but "*the government has relied primarily on an economic rationale*".

Policy development continued into the 1980s when Conservative governments reformulated the Robbins principle. In the 1987 White Paper on Higher Education: 'Meeting the Challenge' which preceded the 1988 Education Reform Act, a revised policy on access included recognition of three routes into higher education: academic qualifications, vocational qualifications and access courses for adults. It also acknowledged the right of institutions to admit people from other routes '*if fully satisfied of their capacity to benefit*'. This change led to rapid growth and 'mass' participation. In 1992, under the Further and Higher Education Act, new universities based on the former polytechnics were formed resulting in the binary divide being abolished and two new sectors were created, a unified higher education sector including the former polytechnics and a further education sector of newly incorporated colleges, focusing on levels below higher education and, like the former polytechnics, removed from local government control. The Act also resulted in the set up of Higher Education Funding Councils for the UK nations. The setting up of the Higher Education Funding Councils also proved to be significant in relation to the development of policy relating to the funding of higher education. For most of the post war period, the constraint on numbers of universities places was largely a matter for the admitting institutions depending upon the physical and financial capacity as perceived by these institutions. This changed in 1994–1995 when HEFCE capped numbers (HEFCE, 1994). The reason for this was that in the previous three or so years, student numbers had increased significantly, more rapidly than expected by the government, thus applying unanticipated pressure to public funding. The influence of government on how HEIs behave in relation to student numbers was gaining ground at this time due to the use of funding formulae by the newly established Funding Councils. (Tapper and Salter, 1994; Deer, 2002). In 1996, a Committee of Inquiry had been agreed by both of the major political parties in response to the 'sense of crisis in UK higher education' (Watson, 2007). The context for the Dearing Committee's works was the acknowledged existence of a serious funding crisis due to the expansion in participation rates. The Government was trying to reduce its

expenditure on higher education while recognising the importance of widening participation to achieve its wider economic and social objectives (Adnett and Tlupova, 2008. p243).

The Dearing Report (1997) made a large number of recommendations concerning renewed growth of student numbers. The government set out a 50 percent participation target with a reformulated concept of access offering *'the opportunity of higher education to all those who have the potential to benefit'* and providing courses *'which satisfy both students and employers'*. This concept represented a change in educational policy and to some extent represents the changing relationship between higher education, knowledge and society. In the past, according to Barnett (1994: 22-23), higher education held a privileged position where it created knowledge which was then made available to society. This relationship is changing in response to changing economic pressures and expectations of individual members of society as described by Barnett (1994) when he states *"Crudely speaking, society is coming to determine the forms of knowing that it wishes for itself. It is no longer content to leave their definitions to the academics;...or even their production. Higher education, furthermore, is having to respond to the epistemological agenda being put on it by the wider society"*. Political policy continued to influence the further expansion of the sector with the justification for the further expansion related to improving the economic performance of the nation in addition to the policy of widening access. In the 2003 White Paper – *The Future of Higher Education* it states that the long term challenge for British universities consists of: (i) improving standards; (ii) widening access; (iii) strengthening links with business; (iv) competing globally. The White Paper requires universities to make better progress in harnessing knowledge for wealth creation (DfES, 2003, p. 17). Charles Clarke, Secretary of State for Education and Skills at the time, suggested that the wider non-economic benefits as suggested in the Robbins Report (1963) are *'overrated'* and that *'universities exist to enable the British economy and society to deal with the challenges posed by the increasingly rapid process of global change'*.

Dearing (1997) recommended increasing the public funding of higher education and crucially the introduction of a graduate contribution to tuition costs. The Dearing Report highlighted that universities and colleges cannot continue with the reduction in the unit of funding of recent years *'without significant damage to the quality of the student experience and to the research base'*. The Dearing Committee recommended that individual students should meet part of the costs of full-time higher education when they could afford to, through repayment loans after graduation linked to income and by that grants be restored to support those from low income families (Wagner, 1998). As the Report itself states *'There is overwhelming evidence that those with higher education qualifications are the main beneficiaries from higher education in the form of improved employment prospects and pay. Individuals who benefit in this way are not drawn proportionately from the socio-economic groups that currently fund higher education through general taxation'*. According to Watson (2007) the Labour government at the time implemented most of the recommendations of the Dearing Report with the exception of the recommendations relating to tuition fees.

The economic argument was gaining more significance at this time. The benefit to the economy of the country was stressed repeatedly and also the benefits to the individual of a higher education begin to come to the fore. The rate of return for a university education is estimated to be high (Blundell, *et al*, 2000). Dearing (1997)

drew attention to the significant returns earned by graduates in the labour market when recommending students make a contribution to their tuition costs. This view has persisted as asserted by Adnett and Slack (2008) that the private rate of return of participation in higher education remains above the expected rates of return of alternative investment opportunities of similar risk. Policy makers have conventionally assumed that social rates of return are in line with private rates of return which leads to the further presumption that a rise in participation of ‘under-represented’ groups would benefit society generally.

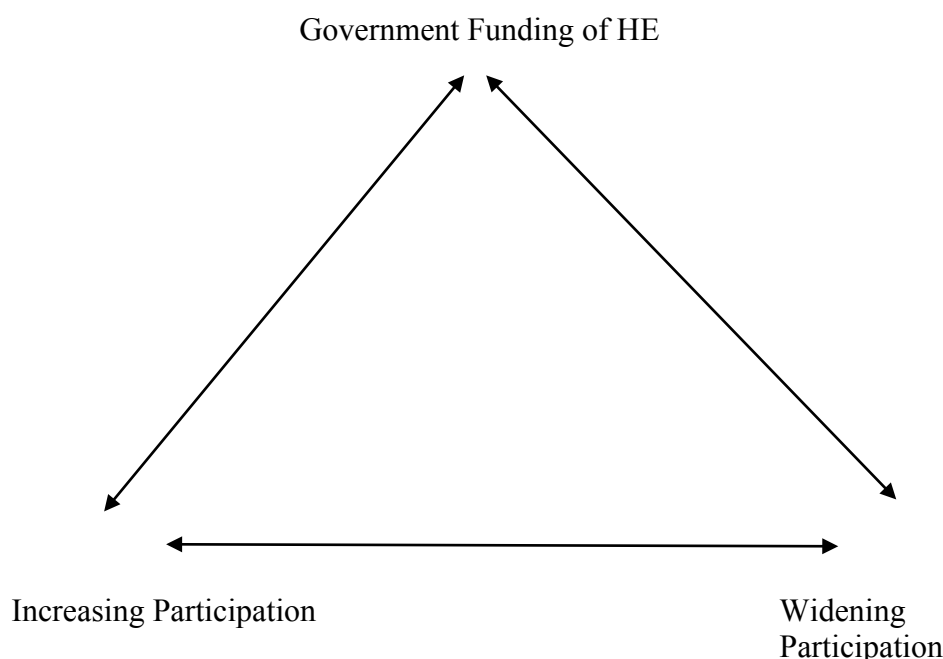


Figure 1. The higher education policy trilemma. (Adnett and Tlupova, 2008)

The economic benefit to the country of widening access to higher education and increasing participation was a significant justification for the continued expansion of higher education (Glennerster, 2002). To be economically successful as a nation requires an educated, skilled workforce. Politically it is also seen as important to be inclusive and ensure those from lower socio-economic groups are able to participate in the technological and economic benefits of the job market as it changes with developments in technology (Mayhew *et al*, 2004). The increasing financial pressure of meeting the policy objectives and funding the higher education system resulted in the further development of the policy with the commissioning of the Browne Report.

The Browne Report (2010) made recommendations on the future funding and organisation of the higher education sector which subsequently the government adopted through changes to the legislation. The key elements of the changes are that any university or college will be able to charge fees of up to £9,000. Changes in funding sources of higher education have posed significant issues for higher education institutions on many levels. The relationship with students and end users has changed as a result. Students are increasingly being considered as ‘consumers’ or ‘clients’ in how they interact with universities. This view impacts on the institution in terms of the level of service they provide, the pressures of meeting the expectations of students

and other end users. The increased expectations of students are coupled with the reduction of per capita student funding putting significant pressure on the system. This can be evidenced by rising staff-student ratios, cuts in academic and support staff across many institutions in an attempt to balance the books. Private payments by individuals will represent a far greater proportion of the funding to universities and there will be more differentiation between universities than currently. Some universities will be able to charge higher fees while others will not be able to compete due to their market position. Universities who cannot charge the higher fees face a reduction in their incomes and may face financial difficulties and potentially a reduction in the quality of provision they can provide (Thompson and Bekhradnia, 2011).

The advent of league tables and their impact on reputation, research income and student recruitment is also a significant challenge for many institutions. The position of a university in any league tables will impact significantly on its brand image, which will inevitably impact on its ability to attract potential students (James *et al.*, 1999; Palacio *et al.*, 2002). Asthana and Biggs (2007) argued that the National Student Survey (NSS) has become increasingly important in the decision making process for students in selecting which University they will attend. Recruitment and retention of students has moved up the agenda of universities' due the policy to increase the UK student population in line with Government targets. Poor retention rates have adverse funding consequences for institutions (Rowley, 2003). Thus recruitment, student satisfaction and retention are closely linked and student satisfaction has become an extremely important issue for universities and their management.

As a result of the development in policy, three key stakeholders have emerged as critical to higher education within the built environment area, namely the providers of higher education undergraduate degrees, the users' of higher education and the construction industry which relies on graduates to support its activities. Providers of higher education will need to attract sufficient numbers of participants to remain commercially viable under the new system, users of higher educational will expect value for money and a satisfactory return on their investment and the construction industry requires sufficient numbers of high quality graduates to enter the sector. Balancing the competing needs of the differing stakeholders and ensuring adequate levels of satisfaction will present challenges to all parties. The factors influencing satisfaction for the stakeholder groups need to be identified and understood to ensure the challenges can be satisfactorily met.

3. Research Design

A review of the literature will be undertaken to establish the purpose and nature of higher education in England and to ascertain how the provision of professional education within the built environment sector meets the established purpose and nature of higher education. An element of the literature review is to identify the key indicators of stakeholder satisfaction drawn from established surveys used within the sector such as the National Student Survey (NSS), league tables published by the Times, the Guardian *et al* and measures of employability. The themes and concepts of indicators of satisfaction identified within the surveys will be established and the influence the results have on policy and provision within the sector will be reviewed. The outcome of the preliminary research is to identify which factors are critical to ensuring stakeholder satisfaction from the many identified issues.

The primary research methodology to be used is qualitative in nature. This approach will be used to understand meanings, describe and understand experience, ideas, the beliefs and values of the various stakeholder groups. Semi-structured interviews were conducted with representatives from the identified stakeholder groups as a method of providing a baseline view of the stakeholder expectations of higher education in terms of its nature; purpose and expectations associated with participation in higher education.

The themes identified as key indicators of satisfaction within the literature were used as the basis of the interviews to establish if the identified issues are in fact the issues of concern to the key stakeholders or if other matters are asserting an influence.

The responses of the stakeholders were analysed to establish the following:

- a) The expectations of the stakeholders associated with the provision of higher education.
- b) The expectations of the stakeholders associated with participation in higher education.
- c) If the stakeholder groups have similar or varying ideas of what provides a satisfactory experience of higher education.
- d) The expected output of a university education.

The primary research methodology used was qualitative in nature. Semi-structured interviews were undertaken with representatives from the identified stakeholder groups as a method of providing a baseline view of the stakeholder expectations of higher education in terms of its nature; purpose and expectations associated with participation in higher education. Interviews were conducted with two senior academics, three sixth form students who intended to begin a built environment degree in September 2012 and three industry professionals involved with the training and development of construction graduates. The participants for the interviews were selected based on their knowledge and experience of the higher education and construction industry.

4. Findings

The representatives from the three stakeholder groups expressed concern relating to the changes to higher education policy in England and the likely impact to them professionally and/or personally. The changes to the funding of higher education was identified a major factor for the universities due to the impact on income and the business model within the institution. All the participants agreed that students will still continue to participate in higher education but would be more discerning in their choice of university. The evidence suggests that student expectations will be greater in terms of student experience, interaction with university staff and industry contacts. The student is also more likely to consider participation in higher education as an investment and therefore will expect to see a return in the form of increased employability and salary expectations. Universities will need to respond to the reduction in student numbers and increased student expectations. The early indications indicate that the reputation of the university/built environment department as measured by league tables, involvement with industry and employability will be crucial to attracting students and maintaining the supply chain of students into the

university. Industry is concerned that the provision for part-time students will remain in place and a good supply of high quality graduates entering the profession will continue. For industry it is also vital that local provision is maintained for part-time students who are in employment. Graduate skills are important to industry, which are developed through interaction with industry professionals, increasing employability for the student.

The critical issue appears to be the quality of student experience and how this impacts on the ability of an institution to attract students. The importance of the institution to develop a suitable pedagogy to ensure the nature and purpose of higher education provision continues to meet expectations while satisfying student expectations and those of the construction industry was identified as critical for those providers of higher education.

5. Conclusion and Further research

Based on the analysis of the information gathered, it is evident that the changes in government higher education policy will have a major impact on the sector. The continuing move toward mass higher education and the increasing importance of vocational education linked to the professions is impacting on the traditional view of the nature and purpose of higher education. Although the fundamental purpose of higher education, to create and disseminate knowledge remains, it has been shown that the type of knowledge and the ability to apply that knowledge to the world of industry and commerce is increasingly becoming the focus of the participants in higher education. The effects of the policy changes are not likely to be evenly distributed across the higher education sector in England. Russell Group universities are less likely to be affected due to the portfolio of undergraduate degrees they offer and the profile of the students they can attract while the rest of the sector is likely to see a large impact due to the portfolio of programmes they offer. This will be particularly true of the institutions offering built environment education due to the vocational nature of the programme. This will drive a response from the affected universities as some subject areas may struggle if they are not seen to be delivering on the employability expectations of the students. Well managed and responsive universities will be better placed to survive and the positioning in the league tables will be vitally important. As demonstrated by the literature, the issue of funding will impact on universities in terms of student numbers, the ability to provide high quality facilities and staff, and therefore the ability to attract students to the institution. This ability to attract sufficient students with the high levels of academic attainment will be linked to the identified indicators of quality such as NSS and league tables. The push then from universities to improve their standings in the league tables will be vital to their continued success. Therefore, ensuring student satisfaction is again shown to be a key issue for universities.

Interestingly, the evidence appears to show that although the new fee regime is not welcomed by students, other issues such as the quality of provision, employability and quality of educational experience are more important

The response from the construction industry and the professional bodies to the changes in government policy for higher education appears to be somewhat muted. The participants in the industry stakeholder group acknowledge that it could result in less choice for students and potentially less built environment graduates entering the professions but at present it appears to be a non-issue. This is likely to be due to the

current economic conditions and the deep recession in the construction sector. This is containing the demand for graduates and therefore is not impacting on the ability of the industry to function. All the predictions point to problems in the future with skill shortages and this is likely to be the time when industry reacts.

In conclusion, the result of the investigation shows that the change in government higher education policy is presenting the sector with many challenges going forward and is likely to result in the reappraisal of what a university education represents. The evidence from this initial research is pointing very strongly to the importance of ensuring student satisfaction with the experience they receive while at university, the employability opportunities associated with the degree programme and a demonstrable return on the investment the students are making by participating in higher education. To this end the further research will be undertaken which will concentrate on identifying the key drivers to ensure student satisfaction and propose a framework for universities to deliver student satisfaction.

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Drivers, Benefits and Barriers of EMS Implementation in Nigerian Organizations

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Abstract

Previous studies on the implementation, drivers, benefits and barriers of Environmental Management Systems (EMSs) have focused on organizations in developed or emerging economies. Therefore, there is a need to establish the extent to which the findings from these studies are applicable to organizational behavior in developing countries. This paper analyses the results of questionnaire responses from 136 Nigerian organizations in nine industry sectors, on drivers, benefits and barriers that affect organizations' decisions to implement EMSs or exhibit positive environmental behavior. Key drivers are environmental concern, desire for improved organizational efficiency and the opportunity to avoid/contain pollution. Key barriers are the cost of implementation/budget barriers and regulatory agency bureaucracy. The key benefits are reduced environmental accidents and improved site safety, enhanced corporate image, more efficient resource use and improved employee knowledge/awareness of environmental issues. These key drivers, benefits and barriers are compared with results from previous studies in developed economies.

Keywords

Benefits, drivers, EMS, environmental behavior.

1. First Level Introduction

The drivers, uptake, benefits and barriers of EMS implementation across organizations in a range of industry sectors and world regions have been reported in various studies (Bansal and Bogner, 2002; Delmas, 2002; Zutshi and Sohal, 2004; Kehbila *et al*, 2009; Nawrocka and Parker, 2009; Heras and Landin, 2010; Massoud *et al*, 2010; Zorpas, 2010; Boiral, 2011). According to these studies, the motivations for an organization's pursuit of an EMS (or its pro-environmental behavior), and the benefits it expects from such actions are inextricably linked (Zutshi and Sohal, 2004). However, the majority of these studies are either focused on or carried out in organizations based in developed or emerging economies, thereby restricting the widespread relevance of findings (Hertin *et al*, 2008). Even within the current range of studies, country-specific differences in EMS implementation have been identified (Jabbour *et al*, 2012), and linked to factors such as national cultures and country-specific contexts (Darnall *et al*, 2008; Jabbour *et al*, 2010; Nawrocka and Parker, 2009). Therefore, the extent to which findings from previous studies are applicable to developing countries which may have very different cultural and socio-political contexts, should be investigated. This paper aims to identify factors (drivers, benefits and barriers) relating to EMS implementation and other forms of pro-environmental

behavior in Nigerian organizations, and to analyze and categorize identified EMS implementation factors using a specifically-developed model (Kola-Lawal *et al*, in prep). The study presents and analyses data obtained from 136 organizations operating in various Nigerian industry sectors.

2. Review of the Literature

2.1 Regional Influence on EMS Adoption/Pro-environmental Behavior

Though adoption of EMSs (and pro-environmental behavior) is generally increasing in developed, economically vibrant parts of the world, it is receiving nominal attention in other far less developed parts (Bansal and Bogner, 2002; Zutshi and Sohal, 2004). Despite the fact that international EMS standards (such as ISO 14001) have been adopted by geographically diverse organizations, their implementation and extent of diffusion differs in different countries (Delmas, 2002), and it seems that uptake of these standards has been very much country/region dependent. Figure 1 summarizes the international distribution of ISO 14001 certifications in 2010, with Europe and the Far East together accounting for approximately 90.9% of certifications, and Africa/West Asia and Central/South America together accounting for only 6% of certifications.

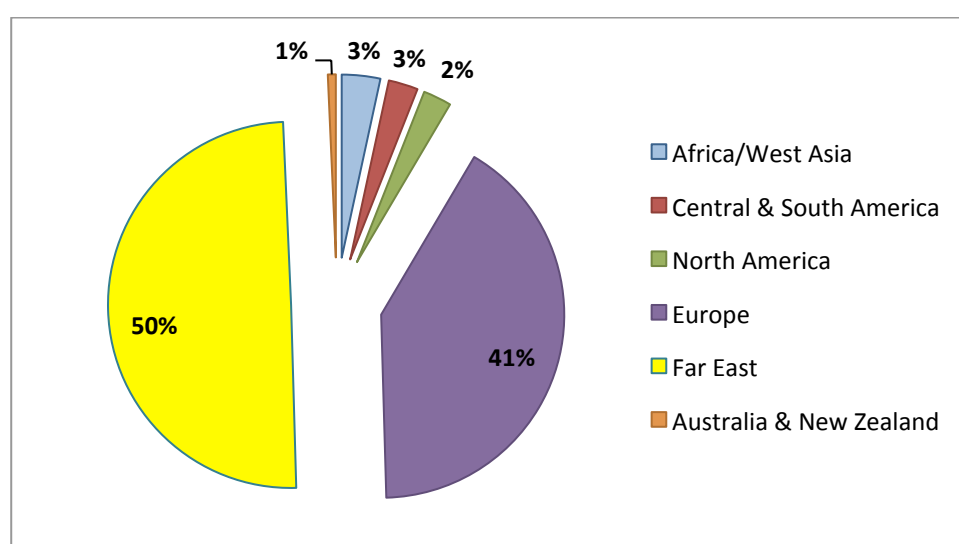


Figure 1: World Share (%) of ISO 14001 Certifications (Adapted from: The ISO Survey)

2.2 Overview of EMS Implementation Factors – Drivers, Benefits and Barriers

In determining pro-environmental behavior like EMS implementation, organizations are often motivated by factors stemming from within, such as internal resources and capabilities (Darnall *et al*, 2008). Some of the most influential drivers of environmental change today include corporate awareness of the finiteness of natural resources and the need for maintaining a sense of stewardship and responsibility towards environmental issues (Gavronski *et al*, 2008), both considered to be strong internal drivers. Organizations are also increasingly influenced by external factors that compel them to play more active roles in environmental management. Market opportunities, government and regulatory influences, and institutional and community

pressures all have an influence on the way an organization manages its impact on the environment, especially in more developed societies (Jiang and Bansal, 2003; Bellesi *et al*, 2005; Zorpas, 2010). Firms which experience little external pressure from outside institutions have little motivation to seek environmental certification, as organizations usually exhibit pro-environmental behavior as a result of external inducement and a desire to reduce external pressures (Bansal and Bogner, 2002; Jiang and Bansal, 2003; Cashore *et al*, 2005; Zorpas, 2010). These external pressures are often referred to as external drivers.

Organizations that invest time and resources in implementing EMSs, do so as a result of actual or perceived benefits which may be derived, and subsequently want to experience returns on investment (Cashore *et al*, 2005; Gavronski *et al*, 2008; Heras *et al*, 2011). EMS benefits include: (i) regulatory and compliance benefits, which organizations derive through awareness of their environmental legal and statutory requirements thereby attempting to operate within those requirements (Zorpas, 2010); (ii) human resource benefits, where employees are positively affected when they genuinely believe an organization is adopting pro-environmental behavior for what is considered to be the 'right' reasons (Jiang and Bansal, 2003); (iii) positive economic impacts, whereby EMS implementation is likely to lead to source and pollution reductions, process intensification and improvement, improved waste management and improved productivity, all of which typically result in cost reductions and subsequently, cost savings (Bansal and Bogner, 2002; Curkovic and Sroufe, 2011); (iv) market access benefits, where EMS implementation has the ability to provide organizations with access to new and existing markets (Bansal and Bogner, 2002; Curkovic and Sroufe, 2011); (v) positive impact on external corporate image, where EMS implementation becomes a corporate public statement and affords the opportunity of communicating to external parties – customers, suppliers, regulatory bodies, investors and the general public (Curkovic and Sroufe, 2011); and (vi) the opportunity to improve environmental performance and efficiency by creating support for the implementation of other environmental practices (Radonjic and Tominc, 2007; Gonzalez *et al*, 2008; Comoglio and Botta, 2011).

EMS barriers usually arise from the cost of pro-environmental initiatives. For example, there are direct and indirect financial implications associated with EMS implementation (Chan and Hawkins, 2010), including time and human resource costs and the costs of engaging external consultants. In addition, externally certified EMSs like ISO 14001 have been widely criticized for not being sufficiently linked to environmental performance. This may be because EMS standards like ISO 14001 mainly focus on management interventions required to implement a functional EMS, and do not have inherent performance indicators or measurement metrics. As such, they cannot be referred to as performance standards but rather management standards (Bansal and Bogner, 2002; Delmas, 2002; Zorpas, 2010). Such criticisms may constitute a barrier to EMS adoption.

2.3 The link between EMS Implementation Factors

According to Zutshi and Sohal (2004), EMS drivers and benefits are inextricably linked. This is also true of the relationship between EMS drivers and barriers, as an EMS implementation factor which drives an organization to display pro-environmental behavior may also bar another from implementing the same. Table 1 shows how EMS factors may serve multiple functions as drivers, benefits and barriers

to EMS implementation in organizations. For instance, regulatory/legal demands/pressures can serve as a powerful driver of pro-environmental behavior (Tomer, 1992; Melnyk *et al*, 2002; Henri and Journealt, 2007). This EMS driver can motivate organizations to adopt EMSs in an attempt to seek compliance with regulatory standards. Simultaneously, regulatory pressures can also act as barriers to EMS implementation (Massoud *et al*, 2010), preventing organizations from exhibiting pro-environmental behavior.

2.4 EMS Factor Categorization Models

It has been postulated that the factors influencing organizational pro-environmental behaviors, including EMS implementation, can be categorized in various ways (Darnall *et al*, 2008; Gonzalez *et al*, 2008; Heras and Landin, 2010). Table 2 presents a summary of EMS factor categorizations from previous studies.

Table 1: Relationship between EMS Implementation Factors

EMS Implementation Factor	EMS Driver	EMS Benefit	EMS Barrier
Regulatory/legal demands/pressure	√	√	√
Market advantages	√	√	
Customer/client requirements	√		√
Opportunity for new approach in environmental management	√	√	
Employee relations	√	√	
Resources (Human, economic, infrastructure)	√		√

2.5 Harmonization of EMS Factor Categorization Models

Though similarities exist between models for categorizing EMS implementation factors, there is little direct correlation between sets of models as a whole, especially in regard to functional interpretations and terminologies used. As a result of the differences in results of EMS studies conducted in different world regions, there are also marked differences between categorization models (Darnall *et al*, 2008; Nawrocka and Parker, 2009; Jabbour *et al*, 2012), restricting the international applicability of these models (Hertin *et al*, 2008). Harmonizing and re-grouping existing EMS models will provide a model with a wider applicability and cross-regional relevance, and will bridge the gaps of previous individual models, providing a consolidated model which can be used to classify EMS drivers, benefits and barriers across a range of geographical and industry settings (Jabbour *et al*, 2012). Such a classification model has been postulated (Kola-Lawal *et al*, in prep) and is shown in Figure 2.

Table 2: Relationship between EMS Implementation Factors

Research Study	Environmental Driver Categorizations				
Powell and Dimaggio, 1991	Coercive Pressures	Mimetic Pressures	Regulatory Pressures	-	-
Tomer, 1992	Market Incentives	Social Influences	Regulatory Influences	Internal Organizational Capabilities	Environmental Opportunities
Bansal and Howard, 1997	Market Drivers	Social Drivers	Regulatory Drivers	Financial Drivers	-
Bansal and Roth, 2000	Competitive Motives	Relational Motives	Ethical Motives	-	-
Jiang and Bansal, 2003	Market Demands	Management Control	Institutional Pressures	-	-
Matuszak-Flejsman, 2008	Commercial Drivers	Ethical Drivers	Legal Drivers	Economic Drivers	-
Neumayer and Perkins, 2005	Internal (or Efficiency) Motives	External (or Institutional) Motives	-	-	-
Darnall et al, 2008	Market Pressures	Social Pressures	Regulatory Pressures	-	-
Heras et al, 2011	Motivations of an internal nature	Motivations of an external nature	-	-	-
Heras and Landin, 2010	External Drivers	Internal Drivers	-	-	-

3. Methodology

Questionnaires were distributed across organizations in Nigeria ($n = 350$) between August and December 2012. As questionnaires were to be filled directly by respondents in organizations and the accuracy of responses could not be verified, the possibility of an inherent self-reporting bias existed (Casadesus *et al*, 2008). Heras *et al* (2011) reported on the possibility of respondent interpretation problems in studies where EMS motivations and outcomes are measured together, as EMS drivers could also be benefits for respondents. Boiral and Roy (2007) also identified the possibility of reverse causality bias, in which of EMS benefits might influence respondents' perception of its drivers. To reduce these biases and ensure that the questionnaire would be understood by respondents, questionnaire administration involved the following phases:

- a) Phase One: Questionnaire Pre-testing - A pre-testing of the survey questionnaires was conducted. Six (6) organizations, comprising 2 environmental certification bodies, 3 environmental management consultancies and 1 oil and gas upstream

company, were asked to assess the draft survey questionnaire and provide feedback on its suitability and content by filling out a Questionnaire Pre-testing Form.

- b) Phase Two: Questionnaire Pilot Testing - The revised draft questionnaire was then pilot-tested by administering it to twenty-two (22) organizations. Administration was done via email and through direct delivery to each organization's relevant contact persons. After intensive follow-up through email messages and telephone calls, a total of 15 responses were retrieved, representing a response rate of 68% in the pilot survey.

Phase Three: Final Questionnaire Administration - The final reviewed questionnaire was then administered to a total of 350 organizations. Questionnaires were administered via email, local post and direct delivery.

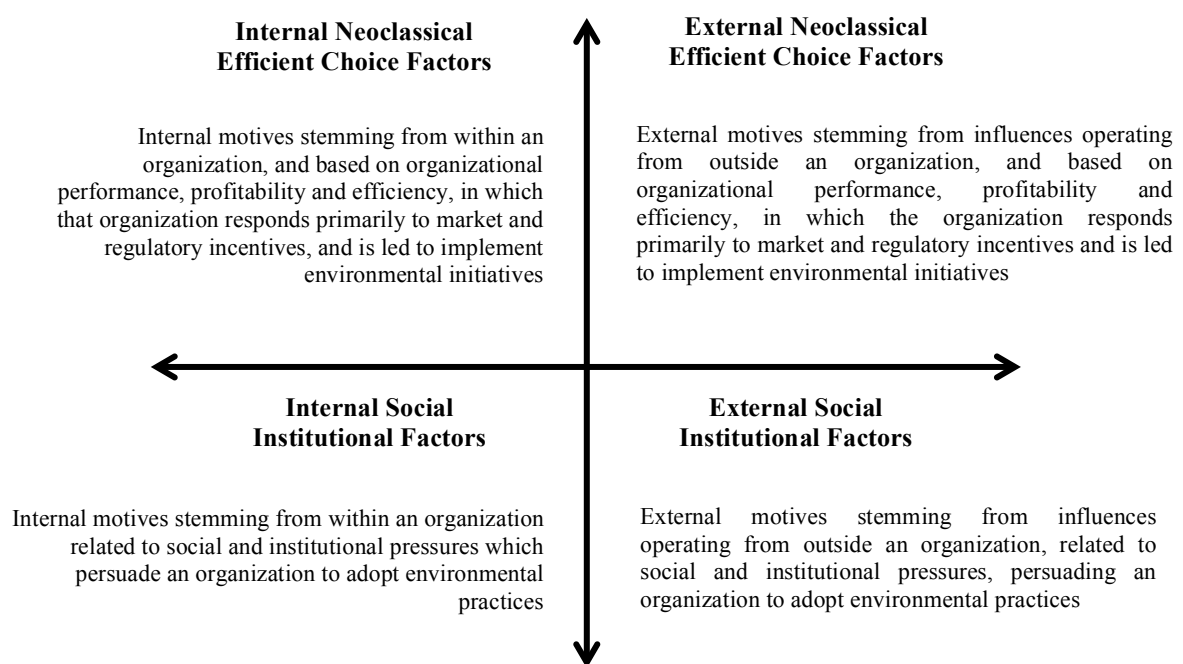


Figure 2: Efficient Choice-Social Institutional EMS Classification Model (Kola-Lawal *et al*, in prep)

- c) Organizations in the following geographical regions of Nigeria were amongst the sample population:
- Lagos region (n = 37)
 - Northern region (North-East, North-West and North Central) (n = 76)
 - Southern region (South-East, South-West and South-South) (n = 23)

Questionnaires were distributed using e-distribution, mass mailing, and direct delivery, whereby questionnaires were delivered to potential respondents and retrieved at a later date. Nine industry sectors were represented within the completed questionnaires received as shown in (Figure 3). As at December 31, 2012, 136 responses had been obtained (including responses from Phases 2 and 3), representing a response rate of 38.8%.

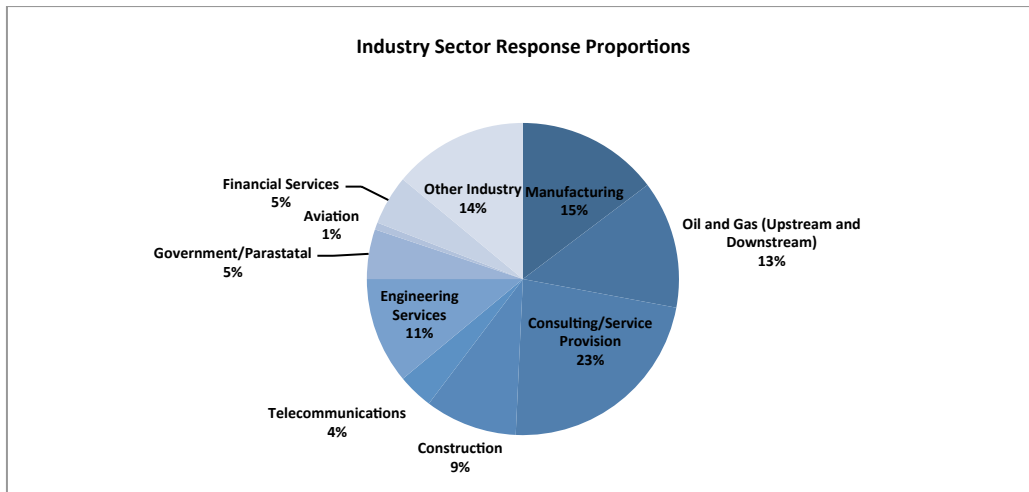


Figure 3: Proportion of questionnaire responses from each industry sector

4. Results

Percentage of organizations rating EMS drivers as 'Very Important' or 'Important'

87% of respondents considered the 'desire for improved organizational efficiency' and 'environmental concern' as being 'very important' or 'important' drivers influencing their pro-environmental behavior (Figure 4). 'Opportunity to avoid/contain pollution', 'regulatory/legal demands/pressures' and 'environmental/social responsibility' were rated by 85%, 84% and 83% of organizations respectively as being 'very important' or 'important' drivers.

Percentage of organizations rating EMS benefits as 'Very Important' or 'Important'

90% of respondents considered 'reduced environmental accidents and site safety' as being a 'very important' or 'important' benefit influencing their pro-environmental behavior (Figure 5). 'Enhanced corporate image', 'more efficient resource use', 'improved employee knowledge and awareness of environmental issues' and 'improved external relations' were rated by 89%, 86%, 86% and 84% of organizations respectively as being 'very important' or 'important' benefits.

Percentage of organizations rating EMS barriers as 'Very Important' or 'Important'

70% of respondents considered the cost of implementation/budget barriers' as being a 'very important' or 'important' barrier influencing their pro-environmental behavior (Figure 6). 'Lack of resources', 'regulatory agency bureaucracy' and 'extensive documentation involved' and 'lack of concern about environmental issues' were rated by 69%, 68%, 61% and 61% of organizations respectively as being 'very important' or 'important' barriers.

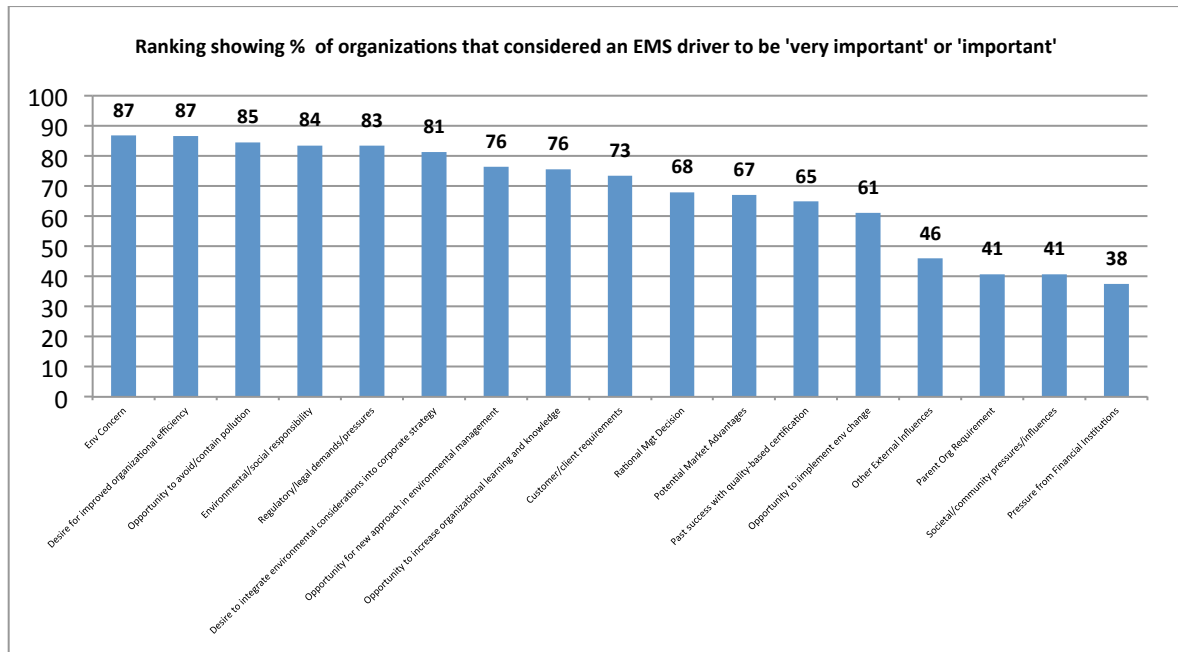


Figure 4 – Organizations that rated EMS drivers as ‘Very important’ or ‘Important’

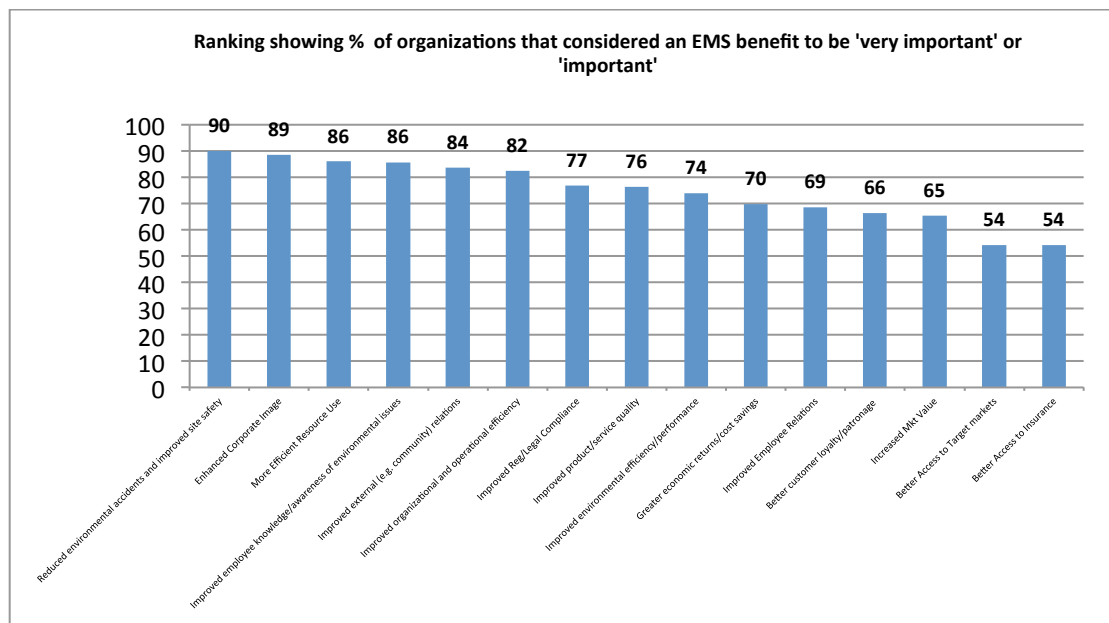


Figure 5 – Organizations that rated EMS benefits as ‘Very important’ or ‘Important’

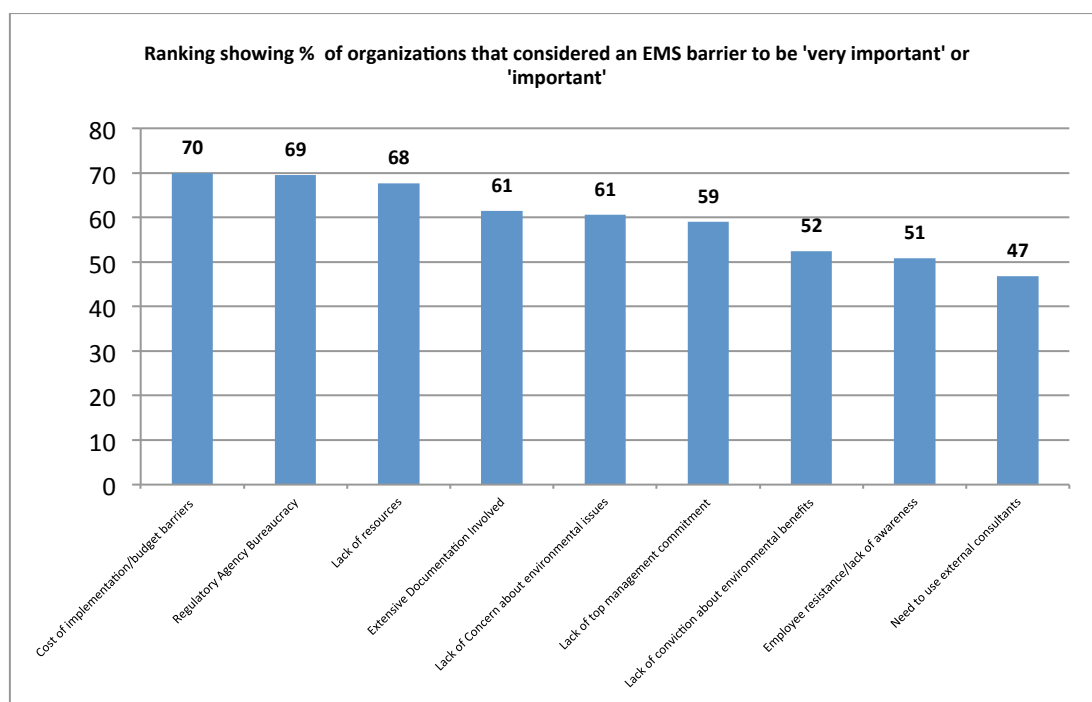


Figure 6 – Organizations that rated EMS barriers as ‘Very important’ or ‘Important’

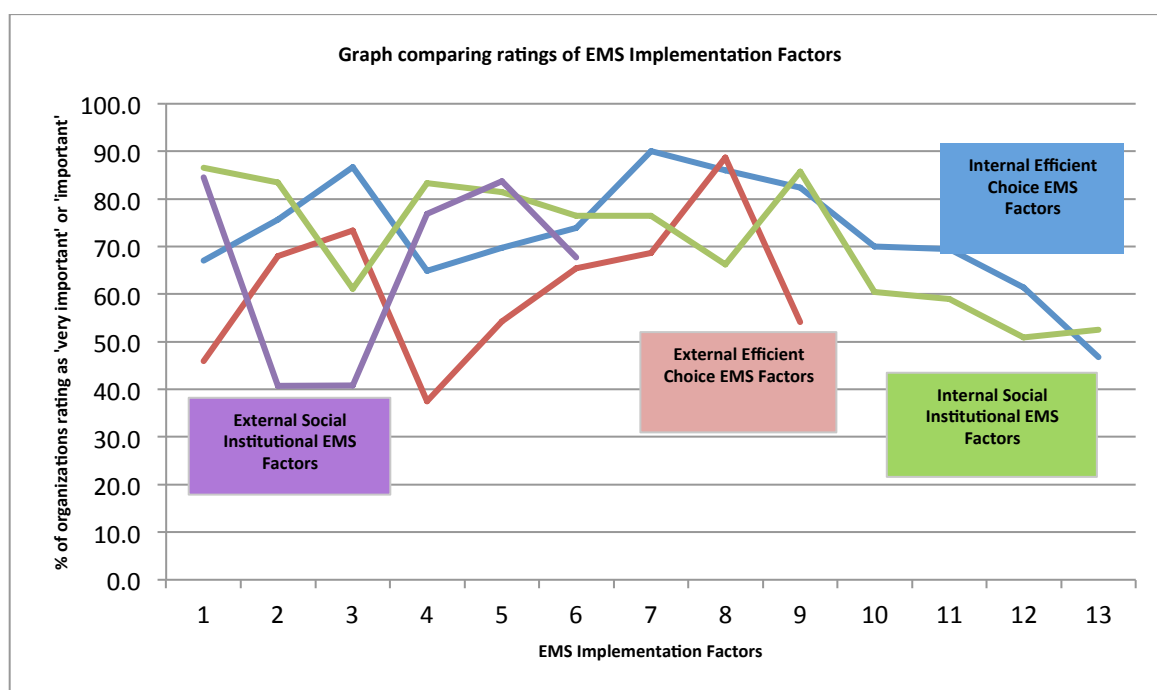


Figure 7 – Comparison of ratings of EMS Implementation Factors

Comparison of EMS Implementation Factors’ Ratings

EMS Implementation Factors (drivers, benefits and barriers) were grouped using the Efficient Choice-Social Institutional model explained in Kola-Lawal *et al*, (in prep)

(in Figure 2 above), and respondents' combined ratings were compared. The y-axis in Figure 7 represents the percentage of organizations rating a driver as 'very important' or 'important'. The x-axis represents EMS implementation factors. The 'coverage area' is a function of the number of EMS implementation factors and the 'very important'/'important' (VI/I) ratings:

$$\text{Coverage area in graph} = \text{No. of EMS implementation factors} \times \text{VI/I rating}$$

The graph shows the blue line (representing all Internal Efficient Choice EMS Factors in the research questionnaire) having the overall highest coverage area. The green line (Internal Social Institutional EMS Factors) with the next highest, is followed by the red line (External Efficient Choice EMS Factors) and the purple line (External Social Institutional EMS Factors).

4. Discussion

EMS Drivers in Nigerian Organizations

From survey results on EMS implementation factors, it appears that both internal (efficient choice and social institutional) EMS factors have comparable influences on the pro-environmental behavior of Nigerian organizations. A high proportion of respondents considered internal efficient choice EMS drivers like 'desire for improved organizational efficiency' (87%) and 'opportunity to integrate environmental considerations into corporate strategy' (81%) to be 'very important' or 'important'. Respondents also rated internal social institutional EMS drivers like 'environmental concern' (87%), 'opportunity to avoid/contain pollution' (85%) and 'environmental/social responsibility' (84%) to be 'very important' or 'important'. This demonstrates that while motivated by efficiency and profitability, Nigerian organizations possess a degree of environmental awareness and concern.

Internal EMS factors appear to influence Nigerian organizations to a greater extent than external EMS factors; as external efficient choice EMS drivers like 'customer/client requirements' (73%) and 'potential market advantages' (67%) were not rated as highly as internal drivers. Empirical literature on EMS drivers reports contrasting results, with studies generally suggesting that EMS motivations are more of an external nature (Zutshi and Sohal 2004; Gonzalez-Benito and Gonzalez-Benito 2005; Heras and Landin 2010). In addition, a large number of studies assert that organizations' pro-environmental behavior is influenced by the demands of their respective markets (Jiang and Bansal, 2003; Sambasivan and Fei, 2008; Darnall *et al*, 2008; Nawrocka and Parker, 2009). The conclusions of these studies are in contrast with survey results on Nigerian organizations. Customer requirements and market advantages do not appear to play a major role in motivating pro-environmental behavior in Nigeria potentially because i) they operate in markets where customers do not associate environmental performance with product quality; ii) market domination can be achieved without superior environmental performance; iii) they do not supply international markets, where supplier environmental performance is considered important; and iv) local markets are not as environmentally sensitive as their developed country counterparts.

The external EMS factor, 'regulatory/legal demands/pressures' (83%) also exerts influence on Nigerian organizations. This result is in line with previous studies

(Matsuzjak-Flejsman 2009; Curkovic *et al*, 2011; Zorpas 2011), which conclude that government-backed regulation is a strong driver of pro-environmental behavior, and will continue to promote the adoption of EMS certification standards. Regulatory drivers are an influential driver for pro-environmental behavior in developing countries like Nigeria, particularly because a failure to achieve regulatory compliance ultimately leads to unwanted outcomes like legal sanctions, fines, penalties and loss of operating licenses and permits. Organizations wishing to implement environmental initiatives become immediately aware of the existence of legal requirements, and their responsibility to operate within them.

Respondents responses also indicated that a lower proportion of Nigerian organizations are influenced by external social institutional EMS factors like 'societal/community influences' (41%) and 'other external influences' (46%) such as trade associations, lobbyists, consultants and educational institutions. This may be due to a level of environmental awareness in these external parties insufficient to influence pro-environmental behavior.

EMS Benefits in Nigerian Organizations

External efficient choice benefits such as 'better customer loyalty/patronage' (66%), 'increased market value' (65%), and 'better access to target markets' (54%), were not rated as highly as internal EMS factors. This demonstrates that Nigerian organizations derive fewer market benefits from pro-environmental behavior than their developed country counterparts. This may be because Nigerian markets are not environmentally conscious or sensitive enough to demand environmental performance.

The link between market benefits and pro-environmental behavior has been emphasized by studies such Quazi *et al* (2001), Bellesi *et al* (2005), Massoud *et al* (2010) and Oliveira *et al* (2010). These studies suggest that (i) an organizations environmental performance may be a barrier to exporting products to international markets; (ii) the existence of EMS certifications facilitates product export to developed country markets, and is useful in overcoming difficult international trade barriers; and (iii) that organizations may lose competitive position in local and international markets by failing to pay sufficient attention to environmental issues. However, though it appears that Nigerian organizations do not gain as many market/trade benefits as they do internal benefits, the degree to which Nigerian markets are environmentally sensitive has not been determined. Market access-driven advantages provided by EMS implementation may be based on perceived rather than actual realities. As such, the extent of environmental sensitivity in developing country markets like Nigeria presents an opportunity for future research.

Survey results showing a positive relationship between pro-environmental behavior and employee relationships in Nigerian organizations are in agreement with those of previous studies, which report the positive, though often difficult to measure, effect of environmental initiatives on organization's employee relationships (Jiang and Bansal, 2003; Link and Naveh, 2006; Gavronski *et al*, 2008; Sambasivan and Fei, 2008; Chan and Hawkins, 2010; Zorpas, 2010; Oliveria *et al*, 2011).

84% of respondents rated 'improved external (community) relations' as being a 'very important' or 'important EMS benefit. However, only 41% of respondents considered 'societal/community pressures/influences' as 'very important' or 'important' EMS driver. This demonstrates that although Nigerian organizations are not primarily

motivated by their external communities, they derive community benefits from pro-environmental actions. This indicates that Nigerian communities may not be as environmentally insensitive as they appear.

EMS Barriers in Nigerian Organizations

The highest rated EMS barriers were ‘cost of implementation/budget barriers’ (70%), ‘lack of resources’ (69%), ‘regulatory agency bureaucracy’ (68%) and ‘extensive documentation involved’ (61%). The cost outlay of pro-environmental initiatives is substantial, and many organizations (including those in Nigeria) are cautious about incurring expenses that do not have a perceived direct link to organizational bottom-line (Jiang and Bansal, 2003; Curkovic *et al*, 2005; Chan and Hawkins, 2010; Zorpas, 2010). Moreover, a barrier to pro-environmental behavior in Nigerian organizations is the challenge of dealing with environmental regulatory bodies. According to Eneh (2011) and Allen (2011), there is a general lack of cooperation between Federal and State environmental protection bodies in Nigeria, leading to bureaucratic delays. Regulatory bureaucracy is also caused by the existence of multiple overlapping functions within environmental protection bodies subsequently leading to overlapping mandates, functions, jurisdictions and permitting systems.

5. Conclusion

Nigerian organizations are more motivated towards pro-environmental behavior by internal (efficient choice and social institutional) EMS factors than by external EMS factors. They also derive fewer market benefits from pro-environmental behavior than their developed country counterparts, potentially because of a reduced environmental consciousness or sensitivity. Similar to organizations in developed and emerging economies, Nigerian organizations are hindered from exhibiting pro-environmental behavior by internal efficient choice barriers such as the cost of EMS implementation, budget barriers, a lack of resources and the extensive documentation involved. External EMS factors such as regulatory agency bureaucracy as are strong driver of pro-environmental behavior. Resource constraints and the high cost of cross-country travel for direct administration restricted the size of the sample population. Future opportunities exist for conducting research on EMS implementation aspects in Nigeria and other developing countries in (i) investigating trends or causal relationships between different organizational characteristics (such as organization size as a function of the number of employees, industry sector, geographical location, organization turnover, organizations ownership structure and organization corporate structure) of organizations in developing countries and how EMS drivers, benefits and barriers are perceived (ii) investigating trends or causal relationships between organizational characteristics and developing countries organizations’ level of environmental management (iii) comparing how organizations rate ‘non-EMS’ benefits (e.g. better customer loyalty) derived from EMS implementation against EMS benefits (e.g. reduced environmental incidents).

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Factors Influencing Graduates' Employability in Vocational Education and Training in the Sultanate of Oman

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Abstract

Vocational Education and Training (VET) is an effective way of supporting enhanced vocational skills levels of trainees and it has become of prime importance in economic, employment and social integration strategies worldwide. In Oman, only a few number of youths enter the Government Vocational Training Centers (GVTCs), compared with the huge number who join academic schools each year. Therefore, this paper critically investigates the factors preventing some Omani youths from entering VET programmes and their effect on the progress of VET itself. Furthermore, it seeks to explore why some graduates from the GVTCs do not practise vocational work after graduation in the private sector. The findings of the study show that the major factors influencing students joining GVTCs or practising vocational work are political, economical, social, cultural and educational factors. These factors not only affect the attitudes of students, but have also strongly affected the efficiency and the progression in VET and graduates' employability. The study concludes with recommendations which it believes would improve the attitudes of Omani society in general and youths in particular, toward VET and manual work, and proposes change in the VET system to bring about substantive incorporation of packages of employability skills.

Keywords

Factors, Graduates Employability, Oman, Vocational Education and Training.

1.0 Introduction

Vocational Education and Training (VET) is considered to be at the heart of domestic and worldwide economies and it plays a most important role in the provision of people, employment, and the workforce to supply the labour market of the world (Al Lamki, 2008). In Oman, throughout all the stages of the Five Year National Development Plans (1976 –to date) VET has received the government's attention and focus (Ministry of Manpower, 2010r). This includes the expansion and development of premises, construction, workshops and the provision of machinery and tools, to keep abreast of the VET developments endorsed by various economic sectors in the country. Continual support for VET and employment improvement has been a steady theme addressed by His Majesty Sultan Qaboos, who in 2006 said: *“As we urge the Omani youth to take advantage of opportunities for education, training and employment available, we would like to draw everyone to call attention to repeated human resources education and training and to encourage workers to take an interest in this vital issue...”* (Shura Council, 2009:4).

However, despite this evident government support, figures show that the level of unemployment of the Government Vocational Training Centres' (GVTCs) graduates is high and some of these graduates also have to be retrained because they do not have the appropriate skills to work (Ministry of Manpower, 2010a). Furthermore, there are some concerns expressed in reports from the Ministry of Manpower (2010b), identifying some indications that show a negative attitude towards manual work may also exist, further adding to a general reluctance to join GVTCs and a scarcity of Omanis in the industrial labour force (Ministry of Manpower, 2010c; Ministry of Manpower, 2010d).

Therefore, this study critically investigates the factors influencing graduates' employability from the perspectives of VET stakeholders; top, senior management, VET officials, trainers, trainees, graduates and the private sector employers.

2.0 Literature Review

2.1 Vocational Education and Training (VET)

VET is not a new idea and definitions of it can be traced back over half a century, possibly because the preparation for vocational work varies substantially depending upon the actual job. The point was made by UNESCO (2001) that country-specific usages of the term VET were evident, and that these came about because of variations in systems of education, and the differing requirements of countries in respect of the human capital needed to ensure the achievement of development goals. As observed by King (2008), VET is part of general education, a preparation for employment, and part of lifelong learning. This definition is acceptable in some developing countries, for example, in Australia and Germany, because VET is included, continuous and linked with the education system and higher education. It is important to this study to become aware that the meaning of VET could vary in different countries; however, this study defines VET as the activities and methods by which trainees in GVTCs in Oman acquire the knowledge and professional skills that qualify them for admission into the labour market for specific careers and professional levels (Ministry of Manpower, 2008).

Oman has placed emphasis on VET based upon several historical, social, economic and political considerations (Ministry of Manpower, 2010e). From 1970 when Oman moved towards a new policy in developing the country, it realised the significance of VET in order to deliver semi skilled and skilled manpower to meet the shortage in its workforce and meet its national development plans. With the accession of His Majesty Sultan Qaboos Bin Said in 1970, came a promise to improve the nation's human resources, and since that time VET has become a high priority on the Omani national agenda (Ministry of Manpower, 2009a; Shura Council, 2009). Clearly great progress has been achieved in terms of quantity in respect to GVTCs. Enrolments in these centres have increased rapidly in spite of annual fluctuations. The expansion of the centres and the rapid growth in the number of trainees indicates the important support given to VET from the higher authorities. But the aspirations for greater achievement in the field of VET are vital to government policy, and it became recognised that the trainees should improve in terms of quality as well as quantity.

In Oman, the objectives of VET focus on preparing the national manpower to meet the Sultanate's development needs for occupational skills; provide the Omani youth

with VET opportunities, to upgrade their efficiency and enable them to take up available jobs in various technical fields; cooperating with the private sector to develop VET programmes according to the occupational standard, to develop employment in work systems and production technologies and encourage trainees to adopt positive vocational oriented work attitudes (Ministry of Manpower, 2010c, Masri and *et al.*, 2010).

Furthermore, according to the Ministry of Manpower (2010d), there are three levels of vocational qualifications offered in these centres, constituting a three-year programme being implemented at the GVTCs; they are: basic training, which is a one year programme aimed at workers with limited skills; specialized intermediate training, which is a two year programme aimed at skilled workers; and advanced specialized training, which is a three year programme aimed at craftsmen. These levels are complementary to both the VET and the technological education in Oman providing the relationship between the GVTCs and colleges of technology, and enhancing their role in meeting the labour market needs (Ministry of Manpower, 2009b). The VET system allows trainees who complete grade ten at school to join the first-year programme in the GVTCs, whilst those who complete grade eleven or twelve can join the second-year programme (Ministry of Manpower, 2010e). To make the system more flexible and to enhance trainees' opportunities in finding jobs, trainees in GVTCs can leave the centre after completing any level and can come back to continue their studies after spending some time working in industry (Masri, *et al.*, 2010). In addition, the Ministry of Manpower (2010a) points out that it has enabled the trainees from GVTCs to continue their studies by making the system more open. Distinguished graduates from these centres are now allowed to attend a one-year bridging programme, first implemented in 2008 (Ministry of Manpower, 2009a) and equivalent to the foundation year in the Technology Colleges. After this, they can join the Technology Colleges to continue their studies. Therefore, this study will focus on VET stakeholders in order to identify the factors that impact the graduates' employability in Oman.

2.2 Graduates' Employability

This concept of graduate employability has been defined over the past decade or so, although it has quickly recognised itself as a leading concern in the strategic direction of "graduation" particularly in education aspects such as VET and higher education as well as skills agenda (Pool and Sewell, 2007). This is because many schools, centres, institutes and colleges, throughout both developed and developing countries, are becoming increasingly aware of the significance of finding suitable jobs for their new graduates in the global competitive labour market (SNE 2006; UNDESA, 2004; Cava *et al.*, 2009). It is apparent; however, that the argument on the issue of employability up to now has almost completely focused on the development by VET trainees of jobs related to employment skills (Winterton, 2000). Arguably, the consensus among different stakeholder groups in VET seems to be that any real progress in the field of graduate employability is beneficial at institutional, national and global levels (Cox and King, 2006).

The discussion on graduates' employability indicates that several researchers, as well as some educational and management organisations, both in developed and developing countries, have attempted to map out the various dimensions of graduates' employability (Sheldon and Thornthwaite, 2005; Al Ajmi, 2003). Reviewing the

literature shows that this concept comprises a mixture of general and specific fundamentals, such as generic skills (SNE, 2011; Mason et al., 2003), key quality (Holmes, 2001), networks (AGDE, 2006; Arthur and Rousseau, 1996), professional experience (Procter, 2011), student's personal qualities (Brown and Hesketh, 2004; Knight, 2001), teamwork (Greenhaus and Callanan, 1994), performance indicators (Morley, 2001), national key skills (Bloys and Williams, 2000), company specific competencies (Knight and Yorke, 2002), management of knowledge and resources (Stephenson, 1998), employers' perspectives (Little, 2011), organisational culture (Morley, 2001), and capability (Gibbs, 2000).

However, in this study, graduates employability refers to the ability to gain initial employment; hence the interest in ensuring that key skills, carers advice and an understanding about the world of work are embedded in the education system; the ability to maintain employment and make transitions between jobs and roles within the same company to meet new job requirements; and the ability to obtain new employment if required, for example to be independent in the labour market by being willing and able to manage their own employment transitions between and within organisations (Hillage and Pollard, 1998).

2.3 Factors Influencing the Graduate Employability of VET

Following the above discussion of VET and graduates' employability, this section considers the most common factors which affect the employability of VET, as identified literature.

I. Employability skills shortage

Sheldon and Thornthwaite (2005) classify employability skills shortages into three areas: their immediate needs; their concern about the quality or appropriateness of job applicants' skills; and longer term skill gaps. They argue that in each area, the shortfall includes generic and soft skills and personal qualities such as communication, problem solving, teamwork, as well as a range of personal qualities that includes values, attitudes and personality characteristics. Furthermore, Smith (2002) points out that the shortage of VET skills emanates from four main factors: stagnation in apprenticeship numbers; an ageing workforce; the effects of privatisation, outsourcing and downsizing; and increasing reliance on unqualified labour. In the context of VET in the GCC countries, Samman (2010: 3-5) argues that the trainees need to be exposed at an early stage to employability skills in vocational schools. Therefore, given the fact that Oman is one of the GCC countries, and suffers from employability skills shortages in the labour market, VET plays an important role in filling the skills gaps and should contribute to enhancement of the labour market and the provision of skilled workers.

II. Global Unemployment

The ILO (2010) estimates that unemployment has risen by more than 30 million worldwide since 2007 while the number of unemployed youth increased by 8.5 million between 2008 and 2009, the largest year-on-year increase in at least ten years. Against this sombre economic background, VET is under pressure to deal with a host of employment and workplace challenges (Samman, 2010; Shah, 2006). The national unemployment of the GCC has increased and most of them who have finished secondary level schooling have completed VET level. In 2008, national unemployment in Saudi Arabia, the largest GCC, had increased to about 13% and is

estimated to be as high as 35% among the youth aged 20-24; in Bahrain and Oman, unemployment stands at 15%; and in the United Arab Emirates (UAE), it is estimated actual unemployment 14%; Qatar, by contrast, experienced 3.2 % unemployment in 2007 (Samman, 2010; Gulf Talent, 2011). Fasano and Goyal (2004) highlighted that the unemployment issue faced by the GCC countries is making employability more difficult, particularly for educated citizens and VET graduates. This is very much the case in Oman.

III. Social Conceptions

Despite the social and economic change in the developing countries, many misguided social attitudes, often legacies of the past, still hinder the development of VET, especially with regard to manual work (Ali, 1999; Al Balushi, 1999; Al Shanfari, 1991; Al Ghamdi, 1994). Therefore, a negative view of manual and industrial work still prevails to a large extent in most developing countries; the majority of planners of educational programmes, especially those who work in the field of VET, rank this as the main barrier affecting the employability of graduates (Al Marzooki, 1994). Such negative attitudes are perceived as one of the major factors has provoked this study.

IV. Lack of VET Guidance and Counselling

Several previous studies have been conducted regarding VET in some GCC countries, and their results emphasise that there are some barriers affecting the employability of VET, such as a lack of vocational guidance and counselling regarding employability skills, thus leading to low enrolments in vocational jobs in the labour market (Al Ghamdi, 1994; Al Bonyan, 1991). Additionally, for example, VET faces several challenges, for instance, absence of written guidelines of procedures to trainers, as well as lack of briefing feedback and coordination procedures between trainers, trainees and other training executives (Brinia and Soundoulounakis, 2011). It is within the intentions of this study to explore these factors could play crucial role in the effective delivery of VET in Oman.

V. Increasing Foreign Workers

During the last decade, due to the rising level of unemployment among the nationals, other difficult economic and political issues have arisen leading to GCC countries having more concrete policies for enhancing indigenisation and reducing the numbers of foreign workers (Gokhale, 2006). The Gulf Countries have been making statements about the need for indigenisation of the labour force and a reduction in the percentage of the expatriate population and workers for many years. However, during the last decade or so, concrete policies aimed at enhancing indigenisation and reducing the numbers of foreign workers have actually begun to be implemented. A major reason for this is the rising level of unemployment among the nationals which has raised difficult economic and political questions for the governments. Samman (2010: 1) points out that unemployment is the biggest factor facing the Gulf Countries this century; he said that “*with unemployment levels of nationals reaching double digits in all GCC, despite rapid economic growth over the past decade, the region must effect wide-scale changes in order to reverse the problems of unemployment*”. This forms a national problem in Oman and is considered a factor that effects the employability levels in Oman.

VI. Lack of Academic Education

In many developing countries, it is apparent that the practical applications of academic subjects are lacking (Samman, 2010). This reflects the fact that education in the earlier stages is theoretical and does not serve development goals or students' preference for theoretical academic education and practical subjects (Gulf Talent, 2011). This feature is a common characteristic among developing countries, where there is a large surplus of graduates from universities and other academic institutions and VET (Tilak, 2002). This may be due to the fact that there are wide gaps between educational planning, economic development plans and present and future human resource needs. This is true reflection of the current situation in Oman given the fact that basic education does not compliment the skills needed to pursue their engagement in VET.

These factors will be further explored in order to identify the current challenges facing Omani youths who wish to engage in VET and further career development through vocational work. The rest of this paper reports on the findings from a qualitative approach which explores these issues.

3.0 Research Methods

This study is part of an on-going PhD programme, which is conducted in three phases;

Phase I – Literature Review which seeks to develop and understanding of VET, and graduate employability, their benefits and limitation in the developed world and GCC countries including Oman.

Phase II – Data collection strategy including qualitative and quantitative methods in order to assess the current situation of VET in Oman and explore the challenges facing VET graduate employability in Oman.

Phase III – Propose a strategic framework for enhancing the VET experience which equips them with career development skills and future employability.

This paper reveals the results of phase II of the research, by focusing on part of the qualitative results and its findings. This explores the factors that influence the graduates' employability in VET in Oman, and those that hinder the engagement of Omani youths in VET and their future employment within the labour market. This was done through semi-structured interviews and focus groups discussions, targeting the top and senior management, VET officials, trainers, trainees, graduates in GVTCs and employers from the private sector, in order to get a blended view of VET stakeholder.

The semi-structured interviews were conducted face to face with the (14) top, senior management, (2) VET officials, (5) trainers in GVTCs and (6) employers from the private sector. In addition, this study used focus group interviews for the 7 groups of trainees, which include (42) trainees and 6 groups of graduates, which include (35) graduates. It was considered that both methods offer the opportunity to ask more exploratory questions about the factors preventing some Omani youths from entering VET programmes and to explore why some graduates from the GVTCs do not practise vocational work after graduation in the private sector (Sutrisna, 2010; Collis and Hussey, 2009; Aouad, 2009; Bryman, 2004). The following section elaborates on the main findings from these surveys.

4.0 Main Findings

This sections gives an overview of the results obtained from the semi-structured face to face interviews, focus groups and the literature review, showing that the factors influencing the graduates' employability in VET have many impacts not only on the employment level of trainees and graduates, but also they also have an impact on the labour market requirements in Oman. In other words, these factors prevent some Omani youths from entering VET programmes and prevent some graduates to practise vocational work after graduation in the private sector in Oman. In this section, the researcher presents these factors as follows:

A. Social and Cultural Factors

Interestingly, the results indicate that the impact of social and cultural factors in VET in Oman still constitute a negative influence on youth wishing to practice vocational work in the private sectors, which unlike developed countries. It was found that the majority of interviewees in this study mentioned the main social and cultural factors, which have an impact on the graduates' employability, as listed below:

- The negative attitude of manual and industrial work such as construction, mechanics, carpentry, electricity, plumbing and so on.
- Some families strongly oppose their sons and daughters entering VET
- Some graduates took up vocational work in consequence of failure in general education
- Some families do not want their children, especially female trainees, to practise vocational work after graduation
- Some private companies prefer male graduates rather than female
- Some vocational occupations which demand manual labour, long hours, physical labour and dirty hands are generally considered undesirable and unacceptable
- Some graduates would prefer to be employed in the government sector than in the private sector
- A common thought that VET has been designed for a category of students, whose special circumstances prevent them from continuing general or academic education
- Some families direct their children towards academic education
- A shortage of encouragement from society for students and graduates to enter and engage with vocational and manual activities
- Vocational work has low social prestige.

B. Educational Factors

Furthermore, the list of finding below, show the factors educational factors affecting the graduates' employability in GVTCs in Oman. It can be said that these factors attributed to the lack of integration between general education system and VET in Oman.

- Low level of academic education among trainees in some GVTCs
- The vocational certificate is not approved and it is not equal to any financial degree
- Trainees' English language level is low so have difficulty in understanding the curricula

- The practical applications of academic subjects are lacking
- Some trainees have no real interest in becoming skilled in the labour market
- Shortage in generic, soft skills and personal qualities
- Lack of personal qualities that includes values, attitudes and personality characteristics
- VET programs do not meet the private sector requirements
- Lack of vocational guidance and counselling regarding employability skills
- Difficulty to access some companies' websites
- Some vocational work in the private sector was unattractive in terms of the reward package, the lack of training, vacation entitlements, working hours, social life, promotion, and job position.
- Difficulties of access to information related to type of occupations
- Lack of advice about better careers
- The programs don't consist of employability skills
- Lack of vocational work experience
- Shortage of cooperation from the employer about on-the-job training
- The training program is difficult because it is in the English language
- The limited source of vocational guidance programs in secondary schools.

C. Political and Economical Factors

This section lists some of the political and economical factors mentioned by the participants, which may be impacted by the economic and political changes in the education and training systems in Oman, for example, the contents of the National Five-Year Development plans. Therefore, the interviewees revealed these factors as follows:

- Increasing the numbers of trainees who drop out of GVTCs during the training period
- Omanisation percentage in some vocational or manual work were lower than that in the other occupations
- Lack of government coordination between the private sector requests and the Omanisation' plans
- Some graduates were not ready to join the labour market since their experiences had not been complimented by appropriate practical work
- Some trainees and graduates were not interested in working with manual occupations in the private sector
- Promotion and the overall reward package was less attractive in the private sector
- Some graduates reject the offers of work in some companies such as construction
- Some graduates do not have the appropriate experience and competence to work in the private sector
- Lack of on the job training in private sector organizations
- Lack of data that can be relied upon for planning the workforce in the labour market
- Some graduates do not have the patience and the right ambition
- Lack of knowledge and understanding of the Omani labour law especially in the part of their responsibilities and rights

- Long working hours, fewer vacations, uncertain retirement rewards, lack of job security, lack of encouragement and low salary and financial rewards in the private sector
- Hard work, no job development, no promotion, no training, negative attitudes in the private sector
- The private sector still depends heavily on expatriate workers
- The private companies also prefer foreign labour because Omani labour demand higher wages
- Unavailability of sufficient financial and moral incentives to attract graduates
- Employment of Omani labour under supervision of foreign labour
- Lack of promotion opportunities in private sector
- Mismatch between occupation and specialization
- Increase the number of expatriate workers
- Lack of job stability
- Some work environments are not clean.

Therefore the main findings from the conducted surveys show that the combination of social, cultural, educational, economical and political factors have a negative impact on the perception and engagement of employees in VET in Omani.

5.0 Conclusion and recommendations

Reviewing the literature showed that VET is important education in the worldwide economies and it plays a most significant role in the provision of people, employment, and the workforce to supply the labour market of the world. Moreover, the literature revealed that employability is a central issue to evaluate the success of VET programs and it is an indicator of ability to gain initial employment, understanding about the world of work, ability to maintain employment and make transitions between jobs and roles within the same company to meet new job requirements; and the ability to obtain new employment. Furthermore, the international literature showed that there are many factors that could prevent students from entering VET programmes and thus these factors might prevent them from practising vocational work after graduation in the labour market.

This paper revealed the results of a PhD study focusing on the qualitative data findings in order to explore the factors that influence VET skills and experiences within the Omani private sector. The majority of the respondents confirmed that there are several political, economical, educational, social and cultural factors influencing the employability of VET in the GVTCs and in the labour market in Oman. The main factors can be summarised as: the cooperation between GVTCs and private companies, VET curriculum meeting the employer's requirements, increasing the salary and promotion for vocational work in the private sector, reviewing the Omani Labour Law, including employability skills in VET programs, valuing the Vocational Certificates and encouraging the media to have a role in changing the negative attitude of VET and manual work in society. Therefore, the key recommendation of this paper is essential to improve graduate' employability by providing key employability skills in GVTCs, offering some information about career guidance in schools and during vocational courses, establishing a new financial value for a vocational certificate and increasing the participation of employers in developing VET.

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A Strategic Approach to Implement Management by Objective in the Government Sector in Oman

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Abstract

The term “Management by Objectives” (MBO) was actually coined for the first time by Alfred Sloan in the early 1950s, though Drucker was the one to flesh out the term and bring it to the central position by comparing and contrasting managerial actions over supervision of activities. The international implantation of MBO principles shows that it is feasible to apply MBO in organisations. Despite this evidence of the international application for MBO, in Oman, there is no application of this concept. Several reports show that the pattern in some ministries in the government sector is dominated by a bureaucratic model, which focuses on the organisation of functions as the basis of the hierarchy. Therefore, this paper aims to explore the body of international literature relating to MBO and their relevance to the General Secretariat to the Cabinet in Oman. In particular, the study investigates the challenges facing management and evaluates the applicability of MBO in the Omani context within the government sector.

Keywords

Challenges, Management by Objectives, Oman, The Government Sector.

1.0 Introduction and Background

Management by Objectives (MBO) is not a new concept of management; it can be traced back to over half a century ago. Peter Drucker formulated the term MBO in 1954 in his book ‘The Practice of Management’ and in the early 1960s, MBO became the fieriest topic in the world of management promising to bring about accountability, profitability and productivity (Drucker, 1954). Furthermore, in the 1990s, MBO became a popular strategic planning tool leading to a proper allocation of resources of all kinds (Nashwan, 1992; Kanan, 1995). Generally, there are many studies that have been conducted surrounding MBO effectiveness, for example, Antoni’s (2005) study in which he supported MBO by stressing the commitment of the group towards attainment of their goal so as to promote employee satisfaction and boost productivity. However, Carroll and Tosi (1973), in their research, suggested that an organization’s objectives should be divided on each level of management to finalize the hierarchical clarity of objectives so as to make them attainable at each level and finally make them the goal of the organization as a whole. There are many advantages of implementing MBO, Phillips (1996), and Drucker (1954) explained that applying MBO in any organisation will provide several benefits such as motivation of employees involved in the goal setting process and improvement of their job satisfaction, making them feel more empowered and hence more committed. It also clarifies goals, improves communication and co-ordination and leads to supervisors and subordinates

interacting on a frequent basis to maintain good communication and co-ordination amongst themselves.

Oman is an actively developing country, where investment in managing human resources has been regarded as crucial since 1970 when the present leader, His Majesty Sultan Qaboos bin Said, assumed power from his father (Ministry of National Economy, 2009). Throughout all the stages of the Five Year National Development Plans (1976 –to date) in Oman, human resource management has received the government's attention and focus. As indicated in these national five-year plans, managing human resource is considered a fundamental and essential aspect of the future national economic vision and development of Oman and is now an essential and crucial element of the government's future economic plan. Therefore, this shows the high importance paid to the human factor in Oman's national strategic development process (Ministry of National Economy, 2010). In addition, the seminar titled '*Management by Objectives and Achieving Results for Senior Management*' comes as per the keenness of the Diwan of Royal Court to develop managing human resources, and raise the professional capacity in line with the Royal approach of His Majesty Sultan Qaboos, who accords great attention to human resources and provides various means to promote their performance (Oman Dairy Observer, 2011). Moreover, in the Omani context, in 2012 the Ministry of Civil Service organised a seminar titled "*The Development of Government Performance*" and this seminar aimed to develop the government's performance and to facilitate procedures (Oman Dairy Observer, 2012).

As previously discussed and despite this evident government support, it is clear that the management in the government sector in the Sultanate needs to be developed through the application of new management models, which might contribute to setting goals, action plans and reviewing and evaluating performance on a regular basis. Therefore, MBO could be an effective model that may contribute to developing management and solving the problems and obstacles facing the government sector in Oman.

Therefore, this study is expected to contribute new theoretical knowledge to the body of international literature relating to MBO. In particular, the study investigates the challenges facing management in this sector and evaluates the applicability of MBO in the Omani context within the government sector.

2.0 Literature Review

This section will focus on the theoretical consideration of MBO; the way in which it includes the principles of MBO, the success factors of MBO, and the benefits of implementing MBO. Furthermore, it provides a clear picture of the two main models of MBO.

2.1 Definition of MBO and Benefits of Implementing MBO

Having considered the concept of MBO and how it has evolved over the past decades, it is important to recognise that within the literature, there is much reference to other terminology such as Management by Results, Management of Self-Censorship, and Management of Planning and Working Reviewing. In addition, the literature reveals that there are varied definitions of MBO since there has been a multiplicity of writers, researchers, and different perspectives surrounding the concept of MBO. Hence, in

this particular study the term MBO is defined as a process that includes five stages: setting objectives, action plans, organizational structure, periodic review and performance evaluation. In this study, MBO is considered to be one of the new models presented in modern organization management. The aim of its application is to improve performance and to increase the participation of management and employees in articulating the general and instructional objectives of the departments (Sah, 2012). Besides, it aims to estimate the allotted resources and time limits, and determine the expected level of productivity of every employee so that they become bound to live up to that agreed upon expectation, this also includes a follow up plan and annual evaluation (Akrani, 2010). These are used for re-planning the objectives and work activities (Kotelnikov (2012).

There are many advantages of implementing MBO, and some of these have already been identified in the conceptual analysis and the various definitions presented earlier. However, in a more detailed analysis, various researchers have identified particular areas where benefits can be derived in improving (Al Hawri, 1999; Abu Nabah, 2011; Sah, 2012; Dinesh and Palmer, 1998; Odiome, 1979; Tosi and Carroll, 1968) these include:

- Employee Motivation and Morale;
- Communication and Co-ordination;
- Worker Participation;
- Managerial Support to Workers;
- Workforce Skills;
- Planning and Control and
- Performance Review and Evaluation.

These benefits will be taken into consideration when assessing the applicability of MBO in the Omani government sector.

2.2 Developing Perspectives and Models of MBO

Various theorists have proposed ways of approaching MBO over the years since the philosophy was first suggested. Whilst there are many similarities between different writers, which there are also slight variations and different emphases given to particular aspects of the philosophy and its implementation. This section describes Ducker's and Odiorne's models that show the differing perspectives of the stages of MBO, which mainly influence this study.

a. Peter Drucker (1954)

Drucker (1954), considered as the pioneer of MBO, suggested the following steps in a vision of MBO;

- Set or review organisational objectives;
- Cascading objectives down to employees;
- Encourage participation in goal setting;

- Monitor progress;
- Evaluate and reward performance; and
- Repeat the cycle.

Figure 1 shows the steps considered in this model.

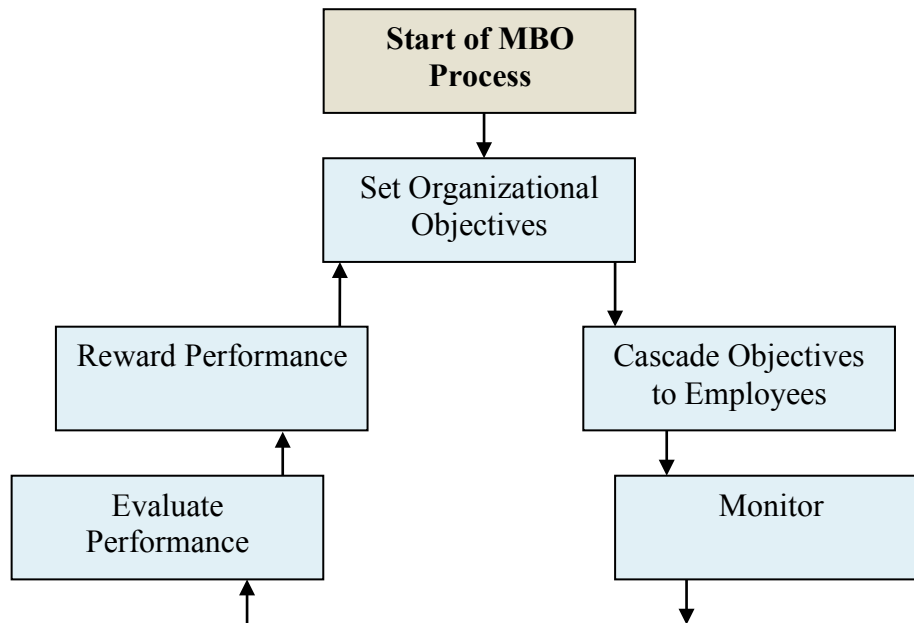


Figure 1: Drucker's Model of MBO
(http://www.mindtools.com/pages/article/newTMM_94.htm)

These stages will help the researcher structure and shape the conceptual framework for this study in order to evaluate the level of utilization of MBO in government sector in Oman.

b. George Odiorne (1987)

George Odiorne (1987) believed that MBO provides guidance for managers in their operations and in evaluating the contribution of the individual workers under their command. In his conception of MBO and how to implement it, he identified the following key steps:

- Identify the general goals of the organisation with the identification of measures of organisational performance to these goals.
- Make the necessary adjustments to the organisational structure to suit the new application. This applies whether they are administrative amendments in the form of regulations or operational changes via the introduction of new systems of organisation and delegation of powers.
- The manager to set goals with subordinates and to identify ways of implementation.
- Mutual agreement between all the subordinates within the organisation, to complete the goals and objectives of the organisation.

- Provide information about the results in relation to the new input.
- Reconsider and review periodically the results of subordinates within the organisation compared with targets set in advance.
- Review of the performance of the organisation as a whole, in line with the objectives of the organisation and goals of subordinates.

Figure 2 represents these steps.

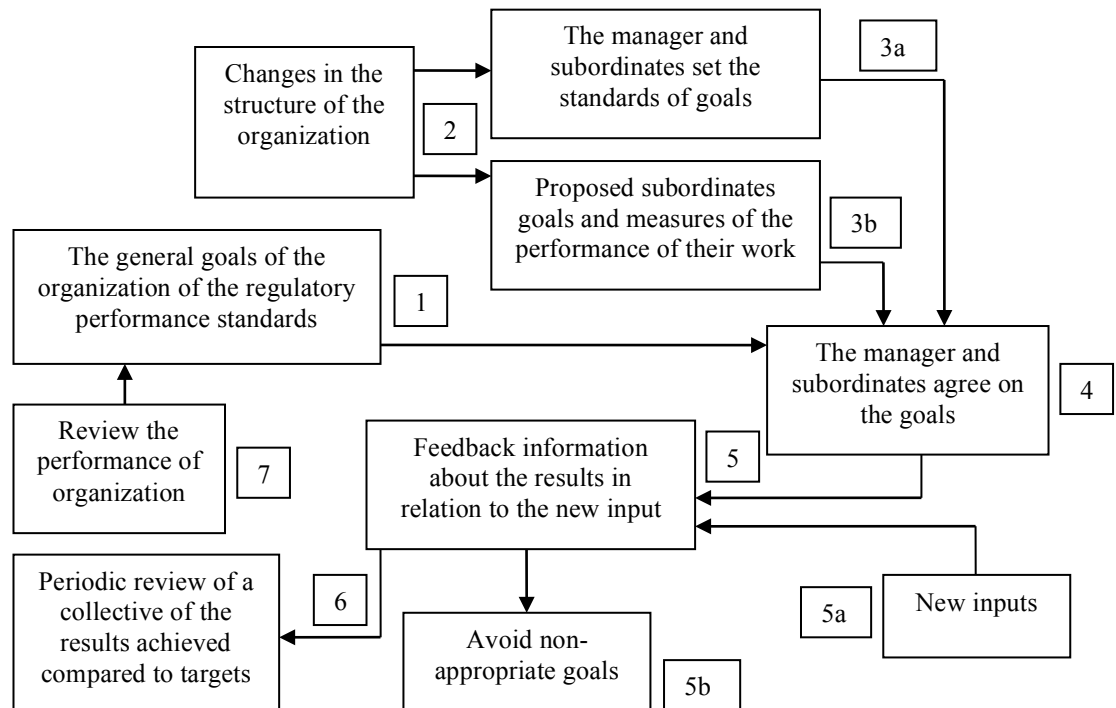


Figure 2: Odiorne's Model of MBO (Al Shumaki (1998:129))

It can be seen that Trucker's model and Odiorne's Model are similar in principle, but differ in the stages of MBO evolvement. This study will therefore benefit from both models when evaluating the principles of MBO within the Omani context.

2.3 Principles of MBO

It can be understood from the previous sections describing the concept of MBO and the various definitions that have been put forward by writers in the field, that in order to apply MBO principles, it is important to develop an understanding of these principles. The literature review shows that there are eight underlining principles for this concept. These are as follows:

- *Participation*: This principle embodies the notion that there should be a partnership between managers and employees in terms of setting objectives, identifying ways to achieve targets, and the means to assess performance and results (Dubrin, 2000; Kreitner, 1995; Dhawi, 1995).

- *Setting Goals*: The principle of setting goals is another important element, and in this matter, Hahn (2007) makes the point that every manager must be able to clearly define the objectives for his/her function in the company.
- *The Monitoring System and Evaluation*: The establishment of a monitoring and control system in organisations that apply MBO is necessary in order to measure results and undertake the periodic evaluation required.
- *Focusing on the Results*: MBO is a systematic and rational technique that allows management to attain maximum results from available resources by focusing on attainable goals (Akrani, 2010).
- *Delegation of Authority and Power*: MBO requires top management to provide clear and visible support, since without such commitment; the synthesis between the individual and organisational goals does not develop (Krueger, 2004).
- *Reward*: The rewards can be of a variety of types and magnitude, ranging simply from a good feeling associated with the achievement, to monetary gains (Briscoe, 2012).
- *Development of Employee and Organisational Performance*: Another characteristic of MBO is its focus on performance improvement, and as the objective-setting is cascaded down the organisation, that performance relates to every single individual, unit, department, etc.... within the organisation, and all the resources that are required to support the overall effort to achieve the objectives Akrani (2010).
- *Concern for Human Relations*: Another element of MBO is its concern for the human relations approach, and hence, it considers the personal goals of employees, as well as their relations with managers and colleagues at work (Al Hawari, 1999).

These principles form the main criteria for the conceptual framework of this study, which will mention in section 2.5.

2.4 Critical Success Factors of MBO

In order to successfully implement the principles of MBO, it is important to identify the critical success factors of MBO and literature shows a number of factors, which have been summarized under this section.

- *Support from all Levels*: Akrani (2010) emphasises that for MBO to succeed, it must receive the full support and co-operation from management since without complete managerial acceptance it will fail.
- *Manpower Required for MBO*: In MBO, managers must be able to listen to their subordinates and subordinates must be able to contribute in an intelligent way (Dubrin, 1997).
- *Individual Motivations*: Another critical success factor in the effective implementation of MBO is top management's realisation that the commitment of individuals to organisational goals is a direct result of their personal motivations, and that it is necessary to appreciate these individual motivations so that they can be satisfied (Mali, 1972).

- *Information Systems*: Akrani (2010) highlights the need for uninterrupted information feedback as a critical success factor for MBO.
- *Measuring Performance*: This may include daily, weekly, monthly or periodic review, depending upon the nature of the objectives and the timescales in which they are to be achieved.
- *Training*: Managers should be given adequate training in MBO philosophy so they reach the position where they can integrate the technique with the basic mission of their organisation (Akrani, 2010).
- *Incentives*: It has been argued that the MBO philosophy in itself provides one important incentive since it recognises that all people are worthy of taking part in decision-making that affects their working lives and provides them with opportunities for self-actualisation that might not have previously been in their workplace (Cook and Hunsaker, 2001; Drucker, 1954).
- *Teamwork*: Teamwork has also emerged as a critical success factor in respect of many modern management philosophies, especially those concerned with quality improvement (Akrani, 2010).

Therefore, these factors will also be used as underpinning criteria for the conceptual framework in section 2.5, in order to assess with the evaluation in Omani government sector. Furthermore, as the review of various perspectives on MBO indicates, there are many researchers who perceive the approach to be worthy of considering in detail and hence implementation. Although it is plain from the numerous models introduced that some are vague and appear to leave room for flexibility in the way an MBO is managed, others are extremely detailed in an attempt to ensure that the fundamental principles of MBO are followed. Moreover, some consider the critical success factors. Therefore, the underlining principles of these models will be used in this research to identify and examine the stages of MBO implementation in the Omani context. The exploration of the variety of studies around the world that have considered the implementation of MBO in both public and private sector organizations helps the researcher to refine the conceptual framework of applying MBO in the Omani government sector, which includes five main criteria of MBO:

- Setting Objectives;
- Action Plan;
- Organizational Structure;
- Periodic Review and
- Performance Evaluation.

2.5 The Conceptual Framework

From the above discussion of MBO principles, success factors, benefits and models, the researcher in this study developed a conceptual framework for applying MBO in the government sector in Oman. This conceptual framework is shown in Table 1 below:

Table 1: The Conceptual Framework for this Research

Main Criteria of MBO	Sub-Factors
Setting Objectives	<ul style="list-style-type: none"> ➤ Objectives are clear and defined. ➤ Employees participate with management in setting objectives. ➤ Management formulates objectives with employees. ➤ Management and employees specify time limits for accomplishing objectives. ➤ Committed to achieving objectives. ➤ Management with employees reviews objectives.
Action Plan	<ul style="list-style-type: none"> ➤ Management in collaboration with employees outlines a clear work plan. ➤ Management in cooperation with employees determines time limits for each part of the work plan. ➤ Work plans specify methods of achieving the objectives. ➤ Work plans consider psychological and social needs of employees. ➤ Work plans include all responsibilities and duties. ➤ Work plans contain training programs for management and employees.
Organizational Structure	<ul style="list-style-type: none"> ➤ Management outlines regulations that organise work in departments. ➤ Regulations include main and sub responsibilities for management and employees. ➤ Management in collaboration with employees identifies any overlap of work. ➤ Management in teamwork with employees specifies duties that might be delegated. ➤ Management offers opportunities for formal and informal communications. ➤ Management involves specific rules for submitting suggestion and complaints.
Periodic Review	<ul style="list-style-type: none"> ➤ Monitoring the implementation of the plan is carried out in light of expected objectives and outcomes. ➤ Management and employees meet on a regular basis for following up the implementation of work plans. ➤ Management provides all information about work performance for employees. ➤ Management encourages employees to revitalize self-accountability and responsibility. ➤ Management in cooperation with employees analyzes the work –related data for following-up the accomplishment of objectives. ➤ Management considers broadcasting the spirit of teamwork between employees.

Performance Evaluation	<ul style="list-style-type: none"> ➤ Performance appraisal is to be linked only to the accomplishment of objectives. ➤ Management concern with employees' satisfaction. ➤ Employees participate with management in their performance appraisal. ➤ Performance evaluation leads to determining needs of training. ➤ Management reward employees according to their achievements. ➤ Management acknowledges and appreciates employees' new ideas.
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It is clear from some of the government reports in Oman that the levels of management in the governmental sector suffer from several management challenges, for example, the weaknesses in implementation of the recommendations of the Five-Year National Development Plans (Ministry of National Economy, 2010). Furthermore, these reports showed that the pattern in the government organisations is dominated by a bureaucratic model, which focuses on the organisation of functions on the basis of the hierarchy. The management at the highest level sets out rules and instructions, and the rights and duties of its officials. In addition there is an absence of clarity of goals set for the administrators and employees in some departments. Furthermore, there is low participation from employees in developing the departmental goals. In the government sector, there is also a lack of clarity in respect of the strategic plans of these departments.

Therefore, the conceptual framework for this study will be as a strategic approach for applying MBO in the government sector in Oman, which could enhance and develop the management style in this sector. Thus, this strategic approach might help to address the challenges facing management in Oman.

3.0 Research Methods

This research is part an ongoing PhD study, which aims to develop a strategic approach to implement MBO in the government sector in Oman. The research is conducted in three stages;

Stage 1 – A comprehensive literature review is undertaken to develop an understanding of MBO principles, models, success factors of MBO and the benefits and derive a conceptual framework in order to apply MBO in the government sector in Oman.

Stage II – Data collection strategy which entails qualitative and quantitative methods in order to investigate the challenges facing the application of MBO and evaluate the applicability of MBO within the governments sector in Oman.

Stage III – To refine and validate the framework for applying MBO in Oman.

This rest of this paper will focus on the findings from Stage II, which adapts a case study strategy for a deep understanding of the applicability of MBO within the Omani public sector. Semi structured interviews (Sutrisna, 2010; Collis and Hussey, 2009) were used, targeting (2) of the top management, (2) of the middle management, (3) of

the lower management and (3) of the employees from the General Secretariat to the Cabinet in Oman.

The General Secretariat to the Cabinet located in the capital city of Oman, Muscat. To analyse the qualitative data in this particular study, the researcher used thematic analysis as it offers a useful and flexible approach to analysing and producing rich and detailed qualitative data (Braun and Clarke, 2006).

4.0 Main Findings

The semi-structured interviews explored the challenges that face the management and employees within the General Secretariat to the Cabinet. The findings showed that

- Top, middle, lower management and employees might suffer from the lack of a clear definition of the main and sub responsibilities and they feel that MBO model could contribute to solving these problems and lead to attain the management goals. The participants also confirmed the importance of MBO for identifying ways of reviewing and following-up the performance to guarantee achievement of the goals. Finally, the participants considered the significance of evaluation performance as an important tool to identify the achievements to get the general goals of the organization as well as the goals of individuals and get feedback for the new plans.
- There is a positive view surrounding the possibility of applying the model of MBO in the General Secretariat to the Cabinet in Oman with the five main criteria of MBO. This indication is also owing to the participants' belief that the formulation of goals is within their interest and their potential careers. Moreover, in general, the findings revealed that the realisation of participants to develop practical plans to implement the departments' objectives could facilitate in achieving the goals in an orderly and timely manner.

These findings will be further testing through the use of questionnaire surveys to the employees and managers within government sector organization in Oman.

5.0 Discussion, Conclusions and Future Work

Management by Objectives is considered to be one of the new models presented in a modern organization management and the aim of this application is to improve performance and to increase the participation of management and employees in articulating the general and instructional objectives of the department. In this paper, the review of the international implementation of MBO showed that there are many benefits of applying MBO in government organizations, such as improving employee motivation and morale, enhancing communication and participation of management and employees, developing workforce skills, improving planning and control, and improving performance review and evaluation in the organisation. Therefore, MBO could be a good management practice in order to assess the effectiveness of the existence of management style in the government sector in Oman and to propose a strategic approach for applying MBO in this sector. This paper revealed the results of semi-structured interviews targeted at top and middle management as well as employees within the General Secretariat of the cabinet of Oman. The results of these interviews indicated that although the principles of MBO are not being applied in the government sector, however, there are positive views that MBO could a good approach to adapt in order to improve the performance and participation of employees

and management within this sector. Future work will entail the selection of another cases study from an Omani public origination to confirm these findings or otherwise. The results will be further tested by questionnaire surreys in order to underpin the factors the will contribute to successful implantation of MBO in Oman.

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Teaching ‘Academic Debate and Critical Thinking’ to Undergraduates in Kurdistan of Iraq: Challenges and Prospects

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Abstract

Iraqi Kurdistan Region (henceforth IKR) is in the north and north east of Iraq with language and culture different from the remainder of Iraq. The paper is based on the assumption that the current curricula in Kurdistan universities are not satisfactorily compatible with the scientific, technological and industrial needs of the Region markets. These curricula neither help students to develop their skills nor to assist them in thinking creatively. Academic Debate and Critical Thinking course is added to first-year curriculum in all Kurdistan universities (in the academic year 2010-2011) as part of the curriculum development process to train students to seek information, produce knowledge, think critically and be leaders and decision makers. In this course, four activities are required: general discussion and critical thinking, seminar presentation, report writing, and academic debate where 25% of the total marks are allotted to each activity. A rubric for each activity is prepared; tasks and activities are done in groups. The results maintain that most of the learning outcomes of this course have been achieved and that the students need more practice in teaching referencing and poster making. They also reveal that teaching critical thinking in the curriculum helps students improve many skills.

Keywords

Academic debate, critical thinking, Iraq

Introduction and Background

This paper presents a case study of teaching the “Academic Debate and Critical Thinking” course, to show how this course prepares students to university life. The paper is divided into eight sections: introduction and background, literature review, data collection and surveys, challenges, opportunities provided, students’ feedback of teachers, results and conclusion, and recommendations. In IKR, students from preparatory school right through university preparation are taught merely to memorize materials and feed them back. Critical thinking skills and activities are not taught or encouraged. This is the case in some other countries as well.

Goodlad states that instruction generally focuses on possession of information rather than understanding its implications or arousing students’ curiosity to involve them in seeking solution to some problems. Eggen and Kauchak mention that many students lack the ability of deep learning or the ability to apply the content knowledge they have acquired to real-world problems (p.71) Moore and Parker, on the other hand, state that many instructions in schools focus on knowledge and how to call the acquired knowledge back, and “the ability of students to think is a matter of ongoing

concern” (p.72) Moreover, many schools with a test-centered curriculum do not always encourage critical thinking skills and self-expression but instead rely on rote learning.

To improve our educational systems, we need to encourage teaching critical thinking skills. Snider states that all over the world educational systems are being reorganized to emphasize active learning, critical thinking and creativity (1). Cosgrove states that students are more likely to internalise the intellectual skills and dispositions when they are explicitly and systematically explained in classroom.

Al Mihimdi, in her study on the effect of critical thinking skills on improving writing skill concluded that “teaching CT is most effective if the instructor models CT dispositions and the proper use of CT skills in the process of instruction”. She also found the importance of encouraging students to be curious, to raise objections, ask questions, and point out difficulties in the instructor's position and to be given reasons for doing things a certain way (118). She suggests conducting a study to evaluate the development of critical thinking skills of college students.

In IKR, the study materials and training curricula at university are currently not satisfactorily compatible with the scientific, technological and industrial needs of the markets. Universities are expected to lead the development of technology and provide solutions to the daily market requirements, but the education and training style in the Region is very traditional; it neither helps students to develop their skills, nor does it assist them in thinking creatively or independently. Generally speaking, in IKR, students from preparatory school right through university preparation are taught merely to memorize materials and feed it back. They are not encouraged to seek information, think critically and contribute to academic debate inside and/or outside the classroom. Curricula Development is a complementary program of the quality assurance process and is important to produce the best administrative and professional staff for Kurdistan region's markets. It aims to educate students to increase their capabilities in research, information dissemination and learning a second language (A Roadmap to Quality).

Taking into consideration the context of Kurdistan Region, a university lecturer who wants to make changes s/he faces challenges like the traditional relationship between students and lecturers where there is lack of communication and the lecturers have an authoritative role.

Academic debate course is added to first-year curriculum in all Universities in Kurdistan as part of the curricula development process to prepare the students to university life. This course helps students develop abilities and skills in academic communication and debate. The topics of this course train the students to seek information, produce knowledge, raise and answer academic questions. It also trains them to accept other's points of view, direct academic arguments, analyze the scientific texts logically and critically as well as to view the community problems academically to offer appropriate suggestions to solve such problem, i.e. they are guided to conduct a critical analysis of what they read. They are also provided with opportunities to practice and develop their skills by writing their reflections on the material studied and on their own learning. All of the above can be considered as the core of critical thinking (henceforth CT).

Literature Review

Eggen and Kauchak (76) define CT as the ability to make and defend conclusions based on evidence. CT includes an attitude of open-mindedness, tolerance for ambiguity, and respect for others' opinions, the ability to separate relevant from irrelevant information and other positive attitudes and dispositions. It also includes different other abilities such as confirming conclusions with facts, identifying unusual assumptions, recognizing overgeneralizations and undergeneralizations, identifying relevant and irrelevant information, identifying bias, stereotypes, clichés, propaganda, etc. (p.73). McKeachie divides the important components of critical thinking into setting goals to achieve, choosing suitable strategies to tackle an assignment, accessing relevant previous knowledge, monitoring their progress. Teachers need to give opportunities to their students in order to talk, write, do field projects, and practice problem solving. He further shows the strategies of teaching critical thinking as teaching students to describe problem elements to bring order out of chaos and verbalizing the reasons of taking a step before taking it lead to improved thinking (326-7).

Teachers can improve students' thinking by frequent use of *why* and by continued emphasis on the importance of evidence (328). Teaching thinking needs training and students, therefore, are in need of developing habits of reflection-thinking about their experience, success and failures, plans and purposes, choices and consequences (330). Brookfield shows the importance of students' participation in small group activities as "the most engaging moments in learning to think critically" (55).

In brief, these elements of teaching can make a difference in students developing thinking, students' writing and discussion, focusing on problem solving methods using varied examples, verbalization of methods and strategies to encourage development of metacognition, and time to think and reflect. To *Moore and Parker*, CT includes a variety of deliberative processes aimed at making wise decisions about what to believe and do and evaluating arguments. To teach CT teachers need to integrate both formal and informal logic, with a variety of useful skills and topics in making sound decisions about claims, actions, and practices and present it in real life situations (xvii). To provide a safe environment for thinking and increasing motivation, *Moore and Parker* suggest the following points:

1. Providing students with information and begin the lesson in an open-ended and non-threatening way.
2. Promoting a spirit of cooperation rather than competition and
3. Focusing on improvement rather than displays of ability. (p.72)

To conclude, one can say that it is necessary for university teachers in order to go beyond essential teaching strategies to promote deep understanding of the topics that they teach, together with thinking. Teaching for thinking increases learners' motivation. Teaching thinking requires a classroom environment where learners feel free to offer their thoughts and ideas without fear of embarrassment. And one of the most effective practices for ensuring performance in the above skills is academic debate. Krieger (2005) defines debate as an excellent activity for language learning because it engages students in a variety of cognitive and linguistic ways. One group of students supports the positive points and the other highlights the negative points.

Academic debate is a disciplined form of arguing toward a person or team of people. (Debate Rules and Techniques) Short (1992) believes in teaching students the skills of critical intellectual engagement and showing them how to engage knowledge in a critical way to enable them change one's own life and one's community. Students must be able to listen carefully to a point of view, examine its strong and weak points in a dialectical way, and then choose for themselves their own beliefs about a subject. Students must "approach received wisdom and the status quo with questions". They need also to be social critics. Essentially, they must apply the same dialectical stance toward the world they live in and the public policies they are asked to live by and participate in enacting.

The benefits of academic debate for students are obvious because of the cognitive and personal changes they get. The studying process will go from memorizing process to a very rapid and efficient activity. The general knowledge that has been gathered by reading magazines, books and articles dedicated to politics, various facts, education or psychology will be beneficial for the class-related activity. Harrison Boyd Summers in his book "How to debate" states the importance of debate:

The student debater learns to use a library, and to find the exact information he needs in the shortest possible time. He learns to be thorough and accurate. He learns to analyze; to distinguish between the vital and the unimportant. He learns the need of proving his statements; of supporting every statement with valid evidence and sound reasoning—and he learns to demand the same sort of proof for the statements of others. He learns to present ideas in a clear and effective manner, and in a way which wins others to his way of thinking. He learns to think under pressure, to "use his head" in a time of need, to make decisions quickly and accurately (cited in How to Debate).

Date Collection and Surveys

Class size

They number of students in academic debate course was 144 with 22 by pass students. By pass students refer to those who study in the second year but are required to undertake the academic debate course with the 1st year students. I divided them into 4 groups (36 students in each group). By pass students were dealt with differently because due to time constraints they were obliged to complete the course in duration of two rather than six months.

Methods of teaching

The philosophy of this course is that learning is a social process and knowledge is constructed, not transferred; thus, students have a great role and responsibility in the learning process. Two hours are devoted to teaching this course, i.e., 4 units in annual system. By the end of this course, students are expected to be able to collect information, analyze, evaluate, criticize it and choose what is suitable to the cases under study. They are expected to be critical in their reading and writing and respect the different points of view. They are also expected to write reports and present seminars, i.e., good writing and presentation skills.

The class is a helpful and engaging medium for academic debate rather than a series of lectures presented by the teacher about academic debate.

Below are the four activities required in this course:

1. *General Discussion, critical thinking and daily activities:*

The students and the teacher discussed a chosen topic and exchanged ideas and viewpoints. Students summarized the main themes of texts given to them or movies played and discussed and debated these themes. The rubric for students' activities during the year evaluated five different items (Students' Understanding, Students' participation in discussions, Group work, Critical questions raised, Quizzes in "in-text-citation, works-cited, making power point and poster") on a scale of 1-5.

2. *Report Writing*

Students chose a topic from the given list or any other interesting topic to write their reports. They summarized, paraphrased or quoted in writing the introduction, main topics and the conclusion. They wrote in-text-citation and works cited. They used internet sources, journals, interviews and books from the library. These reports were scored and suitable feedback was given to students. Students worked in groups in writing reports and presenting seminars. The rubric for students' reports evaluated five different items namely (language and style, organization and relation between reports sections, development of ideas, in-text-citation, works cited) on a scale of 1-5. Examples of reports titles include" Green Tea, Reformation of Higher Education.

3. *Presentation of seminars*

Before presenting the seminar, students were required to do the following:

- Read the topic accurately.
- Summarize the topic.
- Prepare critical questions about it (why is it like that? How is it like that? What are the benefits of the topic? How is it related to the real life?)

While presenting the topic:

- Explain the topic,
- Use interactive presentations (power point, interview, pictures, movies, poster)
- Ask critical questions
- Answer class questions.
- At the end, a summary was presented to the class.

The rubric for students' seminars evaluated five different items (the student's self-confidence/personality, the quality of presentation/ presenting all the main points, language fluency, asking critical questions and answering students' questions, the quality of the prepared power point slides, other interactive presentations) on a scale of 1-5.

4. *Academic debate*

Students were divided into different groups, and each group was of two subgroups, each subgroup alone chose a question to do research on (the questions are related to students' specialization and/or to local problems). Examples include:" TV enhances students' level of English?", All high school graduates should be admitted to universities? We started with the easy topics then the difficult ones. The groups followed these procedures in Debate:

- Gathering information about the topic,

- Analyzing the collected information,
- Preparing the outcomes or conclusions,
- Presenting the result in class,
- The rest of class argued in favor of or against the topic.
- Students chose various topics, worked together, helped each other to present and debate them with their colleagues in class (Student Tutorial).
- The teacher's role was to guide them in choosing the topics, getting information, and monitoring the academic debate.

The rubric for students' debates evaluated five different items (types of argument, language fluency, academic behavior, response to other part's questions, managing class debate) on a scale of 1-5. The skills and topics studied in "Academic Debate" course included debate theory, Ethics of communication, class discussion, oral presentation skills, slide and power point presentation, making poster, constructing an argument, speed reading, report writing, and reference management. Teaching classes started in December and the first week was the induction week where 1st year students visited the department and college library, computer labs, internet unit, other units of college to be familiar with. Moreover, during the induction week the students were given the course book (CB) and asked to read and understand it. I started the real teaching by explaining the ethics of communication and discussion, how to debate and how to respect each other's ideas in the class. Then I gave them some articles on "how to study and how to prepare for the exam". I asked them to read these articles in groups and discuss them in the class. In every group there were six students of different levels to help each other. I assigned some of the high level students to help others as tutors (but not doing the tasks instead of them). I gave them my emails to contact me and I took all their emails. Some did not have emails, so I asked their colleagues to help them open an account. In Kurdistan universities there is no intranet and no students' portal although with this reform some personal attempts have been made by lecturers to make an online platform to connect them with the students. I sent them the assignments via emails. I gave the assignment both orally and printed in the classroom. They started their daily participation by reading articles, summarizing the main ideas, discussing them in class with their colleagues and debating the issues. Students were involved in the process of "conceptualizing, applying, analyzing, synthesizing, and evaluating information gathered from or generated by observations, experiences, reflections, reasoning or communication" (Paul 1995).

I noticed that only 27 of them have good speaking skills; 13 students try their best to speak English and improve their language skills; 20 of them do not understand English at all and they need translators in the class and the rest do not have good mastery over English language and want to learn English language at college. Another task was to watch movies at home and write the main themes to be discussed and debated in the class. The movies were educational talking about schools, teaching, dealing with trouble making students, managing difficult classes. I brought these movies from the USA, Amazon.com. Most of the students did well in this task and they enjoyed watching the clips in the class where I showed them a scene and asked them to

give me the theme and say whether they are with or against the idea and why or if they were to be this character would they behave in the same way or not and why.

The other task was to prepare them for the seminar presentation and report writing. We visited the college library then the central library in Erbil, showing them the American corner to read books and copy what is needed for their reports, and visiting all the other parts like: reference section, journal and periodicals, books section and showed them how to borrow books, for how long they can borrow and how to use them.

Next we distributed the titles from the course book and gave them the freedom to choose other titles if they like. I showed them how to distribute tasks among the members of the groups, how to work in groups, how to write, summarize, paraphrase and cite (in-text citation and works cited) according to MLA style that is followed in the department. I explained only four sources (books, journals, interview and internet). This part was difficult to most of them until they wrote their reports and I gave them feedback on their incorrect use of citation. They learned referencing better after I gave them another chance to correct their mistakes and I scored their reports again and the scoring after the feedback was considered for the evaluation. I showed them practically how to present a seminar. Some students volunteered to present part of their seminars to give them feedback on their mistakes. Not all the students (were with/had) the same desire and energy to work and search. I got feedback from the group leaders and whenever I knew that a student is dependent and is not working well, I asked him/her to present the work alone and then meet with the group to discuss, review, practice, and give feedback to each other.

I required the submission of the report and the power point on a CD. This was particularly important because universities in the region never request soft copies of students' works. This second chance showed improvement in most of the submissions. I also asked them to email and call me if they had any question during March holiday which is not common in lecturer-students relation in the region. Because of the many holidays, I had to compensate students' presentations for more than 20 additional lessons which then led me to work with the compensated groups five extra hours a week for four weeks.

One of their problems in group work was they were not able to meet after class regularly. After March holidays, the students started their seminar presentations and they were told about the rubric for evaluation. Every group was given 40 minutes for presentation and discussion; five for each member and 10 minutes for discussion. Some of the groups did very well, some well, some not good and some of average with poor performance and were not organized because they did not prepare and practice well or the members worked alone and the report sections were not related to each other. I gave them the necessary feedback and gave a second chance for some members of the groups to present again their seminars when they assured that they will perform better.

I noticed that many students attend all the seminars even if they are not in their groups to participate in the discussion and get benefit or to help some of their colleagues with technology. I tried to ask critical questions to help them ask in

the same way. Sometimes I created a debate to increase their interest and make many students participate. We videotaped some of these and took photos for others. I noticed that not all the students prepared their slides by themselves, thus I made a quiz in making power point out of 5 marks to be included in the daily participation and I did it for all the students with the help of two of the assistant researchers in the department who were told how to evaluate the students. It was amazing knowing that all of them tried hard to learn how to make a power point.

I also concluded that many of the students do not understand referencing although it was explained to them three times. I decided to make a written quiz on in-text citation and works cited. I asked them to prepare for the debate and told them to choose debatable topics and ask for help if they needed that. I also asked them to watch YouTube (Doha debate) and I organized a debate in the classroom to show them how to prepare their debate. I gave them the rubric for debate evaluation. We started the debate in May which was the final activity required in this course. The dates for the seminar and the debate was announced and pinned on the wall and also posted on face book. Some changes in the dates were made for some groups to prepare better.

3.3 Out of Class Activities

A group of students presented a seminar on “Land Pollution” to 30 “ Academic Debate” teachers at Salahaddin University as part of curriculum development Directorate activities. Their presentation was satisfactory and amazing to most of those teachers. They showed good self-confidence and answered all the questions and defended their points of view with evidences.

3.4 Evaluation and grading system

The marks of academic debate course is distributed as follows: 25% of the marks go to different daily activities (group work, critical thinking, problem solving and logical thinking activities); 25% to seminar and interactive presentations (power point, poster, film making, etc.); 25% to writing reports, using library, and seeking information); 25% to academic debate. The final result was not announced; instead two of the results of these activities were announced so as not to affect students’ psychology if they fail.

Challenges

The challenges and obstacles faced both teacher and students are as follows:

- The two hours a week was not enough to give the students all the topics assigned in the Dossier of AD(e.g. Speed reading, proposal writing)
- The large number of students did not give the opportunity to all students to get equal feedback about their learning, reports, group work.
- Not enough time to follow up with the tutors and how they help the low level students.
- No fixed assistant to help following up some minor issues of students and reviewing the first drafts of students’ report, referencing, power point, and other issues that need an assistant to be available always. This affected students’ feedback for the teacher in that they were confused who to assess in QA process.

- The new comers who increased day by day till February affected other students by asking always on topics being explained and assignments being given previously. This also made it difficult to memorize their names, know who has problems to help and no time for one on one meetings in office hours.
- Many students found difficulty debating and discussing topics in English.
- Some students did not prepare daily assignments and this made them feel lost when we discussed the material.
- A large portion of students thought they came to English department to learn English language not to study this language or study its history, structure and culture.
- The inconsistent number of students in groups affected distribution of tasks and their regular meeting.
- Each group should be of different levels and this made some low level students depend on active students to do the work.
- Many students put more efforts for learning when given quizzes although the aim of this course is not to test them on information they are expected to implement.

5. Opportunities provided

Out of 166 students, 34 failed. This needed plans for the re-sit exam. The committee of Academic Debate, where I am a member, decided to give another chance to those who failed to have another seminar presentation and report writing, each out of 25 marks. I asked the students who failed to meet with me after announcing the results of the final exam to explain for them what is needed in the re-sit exam. I noticed that all of them use face book accounts rather than emails. I kept giving them feedback on their works via phone calls from 9 am till 11.30 pm; although I mentioned many times that they have to contact me via emails. This was also unusual in the system. I think this was a good opportunity for those who did not learn well in the academic year, for any reason, to learn better since they got the chance of personal contact with me and enough time to review, ask, write, rewrite and learn from others.

Students feedback from teachers

Quality Assurance coordinators in the department distributed students' feedback forms and tabulated the results. The evaluation score of my subject and my teaching was 39 out of 60, which was not satisfactory to me, the head of the department and the coordinator of quality assurance as well. In a study conducted by me and one of my colleagues in the department regarding the reliability of first year students' feedback, we discovered that some of the students did not understand the items well, some do not know Kurdish, thus, they did not understand the items, some did not fill the forms and some interpret the items in different ways.

Results and conclusions

I distributed a questionnaire to the students asking them to rate their learning in 13 topics and skills from 1-5 to find out the amount of learning students get in the different skills they are expected to develop as the learning outcome of this course. The questionnaire was distributed in May and in September. The results are shown in Table 1. The total results of the questionnaire that involved 1st year students and by-pass students in the 1st trial exam and those who repeated the exam in the re-sit exam

show that most of the aims of this course are achieved and students learned all the skills required. It is worth mentioning that students' learning mean in "making poster and learning reference management" is lower than other skills. It is obvious that making posters was explained theoretically only because time was not enough to ask students to do it practically. As for reference management, it is explained 3 times and students were given feedback on it before submitting the final draft of the reports. They visited libraries and studied how to cite sources. This gives feedback to pay more attention to this topic this year. Other results that are above average but not satisfactory are "learning how to use library sources" and "how to think critically". There was improvement in students' performance in these two skills but not as expected compared to other items and skills. Students need more practice in how to ask critical questions, because they were trained in high schools to memorize and recite what they learned, not to analyze, criticize and evaluate. Students in their 2nd trial exam did better in this regard. This also needs priority this year.

Table 1: Total Result

	Mean
making poster	2.55
making power point	4.13
Learning presentation skills	3.28
Learning reference management	2.92
Learning how to use library sources	3.02
Writing reports	3.51
Learning how to ask and answer scientifically	3.16
Learning to think critically	3.09
Improving English language	3.31
Learning how to debate	3.40
Increase self-confidence	3.19
Learning how to study independency	3.17
Accepting different points of view	3.63

Table (2) Comparison of Students Performance Using LSD Test

Activities							
Debate others	with	Report others	with	Seminars others	with	DP&CT others	with
D > R *		R < D *		S > D		DP&CT > D **	
D < S		R < S **		S > R **		DP&CT > R ***	
D < DP&CT **		R < DP&CT ***		S < DP&CT *		DP&CT > S *	

Using ANOVA (f test), the final results of the students in the four activities showed that the difference in students' performance simultaneously is very highly significant. LSD test is used when the result of such a test is significant. Table (00) shows how students performed in each of the four activities. Moreover, the mean scores shows that students did well in daily participation and critical thinking, then in seminar and debate and lastly in report writing. To compare 1st year students, performance with By-Pass students, the results reveal that the difference between them is very highly

significant in report writing and there were differences in other activities in favor of 1st year students but were non-significant.

Table (3) ANOVA (F test)

ANOVA						
Academic Debate						
	Sum of Squares	df	Mean Square	F	t-test P-Value	Decision
Between Groups	436.501	3	145.500	8.576	.000	VHS ***
Within Groups	11130.139	656	16.967			
Total	11566.641	659				

Table (4) LSD test

t-test								
Group Statistics								
Course	GRP1	N	Mean	Std. Deviation	Std. Error Mean	t-test Value	P-	Decision
Academic Debate	Debate	165	14.6545	4.68444	.36468	.044		S *
	Report	165	13.7061	3.79706	.29560			
Academic Debate	Debate	165	14.6545	4.68444	.36468	.615		
	Seminar	165	14.9000	4.16694	.32440			
Academic Debate	Debate	165	14.6545	4.68444	.36468	.005		HS **
	DP&CT	165	15.9909	3.76054	.29276			
Academic Debate	Report	165	13.7061	3.79706	.29560	.007		HS **
	Seminar	165	14.9000	4.16694	.32440			
Academic Debate	Report	165	13.7061	3.79706	.29560	.000		VHS ***
	DP&CT	165	15.9909	3.76054	.29276			
Academic Debate	Seminar	165	14.9000	4.16694	.32440	.013		S *
	DP&CT	165	15.9909	3.76054	.29276			

Recommendations

- Students should be divided into groups of 3 from the beginning till the end of the year to know each other better, learn about their learning strategies, learn from and help each other.
- Teachers of AD need assistants to help following up with students and explain regulations for the new comers.

- More than one teacher should teach this subject, each teacher assigned with 20 students rather than one lecturer with 166 students.
- Low level students (those who do not know English well) need to be given two chances in seminar presentation and debate: one in their native language and one in English. This will help knowing their level of thinking and presentation skills and to increase their self-confidence when they do well in their native language.
- The rubrics need to be modified based on the feedback received from last year's teaching.
- It is necessary to have collaboration between Computer and AD courses, both teachers should work together in arranging their course books to know the exact time for teaching some common topics. The same collaboration is needed with teachers of "communication" who teach reading and writing skills.
- Providing more exercises on critical questions, reference management, poster making, decision making, writing skills such as paraphrasing and summarizing.
- For the time being quizzes are necessary though not preferred. It allows students to put more efforts in their learning.
- Introducing some teaching techniques such as argumentation and debating into the list of school subjects to be studied in high school .This step will encourage practicing academic debate on a large scale in schools, because at present learning by heart is encouraged more than critical thinking.

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Appendix (1) The final Results of the Questionnaire

	1 st Trial 1 st year stu.	1 st Trial By- pass stu.	2 nd Trial 1 st & 2 nd stu.	Total
	Mean			
Making poster	2.60	3.20	2.29	2.55
Making power point	4.19	4.33	3.82	4.13
Learning presentation skills	3.21	3.94	3.12	3.28
Learning reference management	2.74	3.50	3.18	2.92
Learning how to use library sources	2.89	3.28	3.27	3.02
Writing reports	3.37	4.18	3.58	3.51
Learning how to ask and answer scientifically	3.03	4.28	2.94	3.16
Learning to think critically	2.98	4.18	2.84	3.09
Improving English language	3.24	4.06	3.16	3.31
Learning how to debate	3.31	4.33	3.16	3.40
Increase self-confidence	3.05	4.33	3.00	3.19
Learning how to study independency	3.03	4.22	3.03	3.17
Accepting different points of view	3.56	4.28	3.52	3.63

Methodological Approach of Knowledge Transfer Research

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Abstract

The dilemma of this research necessitates a transfer of knowledge, and integration between two multi-disciplinary topics facilities management (FM) and regeneration. The nature of knowledge creation in this research is conceptualized by theory building and knowledge development. This type of theory building in the field of management entails the researcher thinking outside the box, and moving away from the traditional methodological approaches. The idiographic nature of the adopted methodology builds on a combination of action research as the overarching framework, grounded theory as strategy, and using a case study approach. Action research forms the landscape of the research's design. The innovation of grounded theory is in its ability to deal with the subjectivity and reflexivity of both the subject and the researcher. Case study is an appropriate approach to interact within the research context and investigate the role of FM in regeneration and community development. This paper introduces a new philosophical and methodological approach to theory building in FM research.

Keywords

Action research, Community, Facilities management, Grounded theory, Case study.

Introduction

Research is about creating new knowledge and testing its validity and then sharing this knowledge (McNiff & Whitehead, 2010) more specifically, it is about exploration in the pursuit of knowledge (Rugg & Petre, 2007). Moreover, research is not a set of principles or skills, but it is a way of thinking or a way of examining your practice. In social science, research is centered on comprehending human behaviour and social phenomena (Jasso, 2004). If research is claimed to be undertaken, this means that the process of research is implied within a framework of a set of philosophies, applied procedures, and methods that have been tested for their validity and reliability, and is designed to be unbiased and objective (Kumar, 2005).

According to McNiff & Whitehead (2003) there are many ways of doing research; so it is important to be clear about the characteristics of the different methodologies to justify selection of appropriate methodology and what is special about it. The aim and purpose of this paper is to explicate the adopted methodology of this research, through a critical discussion and constructive illustration of the used methodology and its originality in FM research.

The essence of this research goes back over a decade when the pioneers of facilities management (FM) started investigating FM's contribution to sustainable

development. Drivers for this new way of thinking were the massive emphasis on integrating sustainability into FM, and the intention to develop socially driven approaches to FM. The rapid growth of FM as a multi-disciplinary profession has broadened its effectiveness and productivity and thus developed very successful practices within the public, and private, sectors. Since FM knowledge underpins the delivery of successful financial outputs, the ambiguity in the role of FM in delivering social outputs is arguably a result of less examination of FM applicability in the community setting rather than lack of FM capability.

Unfortunately, very little research has been done in FM in the community setting. At first glance, there appears to be very little correlation between FM and developing sustainable communities; but FM has a lot to offer community facilities or organisations that are directly involved in community development. However, critical analysis of available literature has identified a lack of FM knowledge in the community setting, and different types of communities where FM is pertinent. To reiterate, the research is centered on investigating the contribution of organisations' facilities to sustainable communities. More specifically, the research aims to translate the knowledge of successful FM practice into a community setting. To this end, the research objectives are addressed in two dimensions, namely: investigation of FM contribution to sustainable communities, and how FM would support the contribution of community facilities to the community life

Research Philosophy

The philosophical orientation of any research stems from the research discipline and one of the several paradigms and approaches in research, namely: positivist, interpretivist, action, feminist, qualitative, and quantitative etc (Kumar, 2005). In quantitative and qualitative, the researcher's philosophical assumptions are critical in framing the research process (Klenke, 2008). Hence, designing a methodological approach for any research should consider all the different paradigms of ontology and epistemology related to that research.

Most debates of research paradigms centered on the tripartite linkages between ontology, epistemology, and methodology. In addition, pragmatism includes the role of ethical and moral values in researches under the heading of axiology (Klenke, 2008). Burrell and Morgan (1979) discussed that approaches of social science are influenced by assumptions of a tripartite of ontology, epistemology, and human nature. Consequently, paradigm can be defined as a set of beliefs that guide action and consisted of five key dimensions, namely: epistemology, ontology, axiology, human nature, and methodology (Denzin & Lincoln, 2005b; Bryman & Bell, 2007). Every key dimension is addressing a paradigmatic question, namely: how do we know what we know for epistemology, what is the nature of reality for ontology, what is the role of values in the research for axiology, and what is the role of human relationships for human nature, how should we study the world for methodology (Klenke, 2008). In essence, any choice of research methodology is nested in the research philosophy. Hence, the methodology choice of any research is shaped by the researcher's assumptions of the epistemological, ontological, axiological, and human nature, as depicted in figure 1 (Bryman & Bell, 2007; Klenke, 2008).

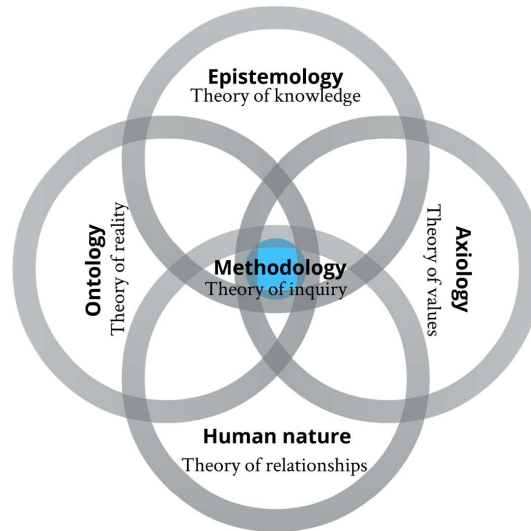


Fig. 1. The core elements of research paradigm

Philosophical Underpinning of the Research

It is impossible to conduct a rigorous research without understanding its philosophical underpinning (Klenke, 2008). Ratcliffe (2000) & Price *et al.* (2009) highlighted the positivistic philosophy as the dominant paradigm of FM research, in which quantitative methodology was chosen by most of FM researchers. This philosophy was excluded because of its failure in considering the behavioural and sociological aspects of FM. Although quantitative research is noted for its objectivity, rigour, mechanistic efficiency and issues of reliability, qualitative research is the preferred philosophy because it provides richer comprehending of complexities inherent in any management scenario (Price *et al.*, 2009).

The problem of this research is centered on the investigation of the role of FM in community development. The literature review has identified limited and narrow FM knowledge in the community setting, and more advanced FM knowledge in the corporate sector. Therefore, the problem context requires the researcher to understand the social world of FM and the potential of facilities in a community setting, in order to translate the knowledge from the first sector to the second. Thus, translating knowledge of successful FM practice to the field of community regeneration and development necessitates the integration of complex and multiple disciplines and approaches to FM and regeneration. This translation requires the researcher to step away from the traditional FM research methodologies.

This research adopts a social constructivist and interpretivist philosophy. Supporting this, Denzin & Lincoln (2005a) discuss that constructivist paradigm presumes relativist ontology, interpretive epistemology, and idiographic set of methodological procedures. Idiographic research is a social research based on certain events, documents, and specific elements. In this research, it deals with specific elements of community, facilities, and FM, where the knowledge of FM is seen as being dynamically and socially constructed with particular emphasis placed on how FM practice could act in the community context (Goulding, 2007).

Thus, the philosophy of this research, as depicted in figure 2, refers to the epistemological (interpretivist) and ontological (constructivist) assumptions that will

guide the researcher in his investigation. The logical underpinning of the research philosophy is inductive, and idiographic in presenting the epistemological assumptions. Furthermore, figure 2 clarifies the subjective stand of the research philosophy in terms of axiology and the voluntarism stand in terms of human nature. The subjective research is biased and value laden, in that individual's values and beliefs influence the research decisions (Pathirage et al, 2008). Those beliefs and values are made explicit by the researcher, where he does not investigate the existing role of FM but the nature of this role. It is voluntarism because all the individuals are completely autonomous and free-willed, and being able to shape the world within their sphere of influence (Morgan & Smircich, 1980)

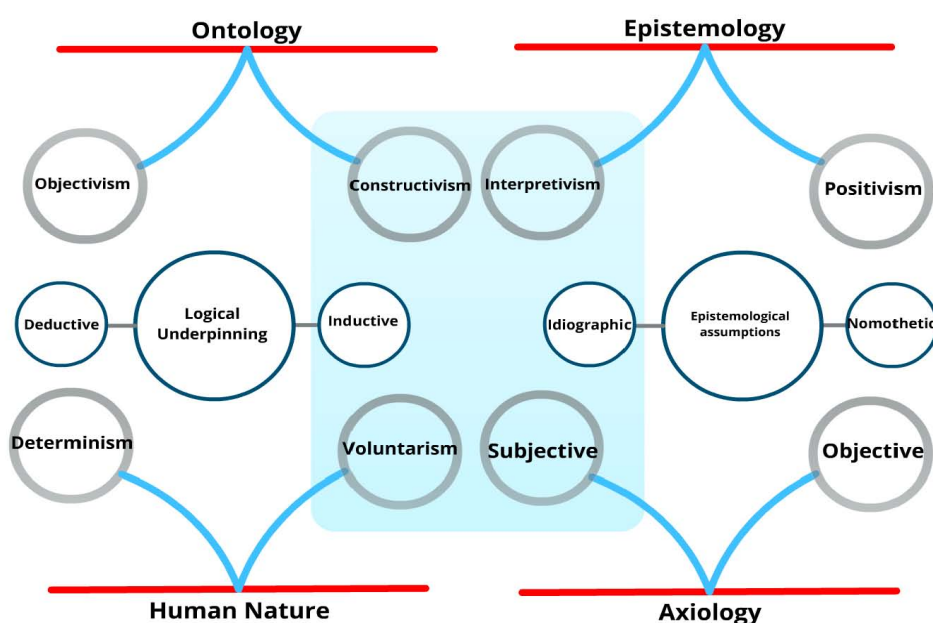


Fig. 2. The research philosophy

Research Methodology

Corbin & Strauss (2008) use the term 'research methodology' to refer to the researcher's way of thinking and studying social phenomena. The choice of methodology is determined by the epistemological, axiological, and ontological assumptions (Kumar, 2005). Epistemological and ontological assumptions are translated into distinct methodology. The methodology reflects the researcher's beliefs about the studied knowledge and values inherent in the research paradigm (Klenke, 2008). Tashakkori & Teddlie (1998) link research methodology to its questions, stating that decisions regarding the use of either qualitative or quantitative (or both) is based on the research questions.

Quantitative research methodology is a "systematic, controlled, empirical, and critical investigation of natural phenomena guided by theory or hypotheses about the presumed relations among such phenomena" (Kerlinger, 1986, p.10). Quantitative school is reflected in positivist epistemology, while qualitative research methodology is reflected in interpretivist epistemology (Leed & Ormrod, 2005). Qualitative research is "multi-method in focus, involving an interpretive, naturalistic approach to its subject matter" (Denzin & Lincoln, 1994, p.2). It is seen as research that produces

findings not arrived at by means of statistical procedures or other means of quantifications (Strauss & Corbin, 1990). Moreover, it studies things in their natural setting whilst attempting to make sense of phenomena in terms of the meaning people (sociology) bring to them.

The nature of relationship between theory and research is embedded in the epistemology and ontological assumptions made by the researcher (Bryman & Bell, 2007). The term theory is defined as a statement describing how some parts of the world works or a proposed explanation of phenomena (Robson, 2002); this definition implied the views of positivist and interpretivist. Both forms of theory are underpinned by either deductive or inductive logic, and logic refers to different shapes of interpretation at the disposal of the researcher (Bryman & Bell, 2007). Deductive logic appears at the positivist end of the continuum, where the researcher needs to make conclusions that follow straight from the premises. In contrast, inductive logic appears at the interpretivist end and it requires statements to be made based on the researcher's observation of phenomena (Hart, 1998; Leedy & Ormrod, 2005). Therefore, the key objective of using inductive logic is to place the methodology of this research in relation to the changes that have occurred within the field of FM, in particular the area with regards to the interpretivist influence on generating knowledge, FM in the community setting.

Why Action Research

Action research involves three elements: action 'what you do'; research 'how you learn about and explain what you do'; and participation who involved in what you do (McNiff & Whitehead, 2002; 2010). The action aspect is about improving practice; in this research is about improving FM practice in the community setting. The research aspect is about creating knowledge about particular practice; it is about creating knowledge about the role of FM in sustainable development. The participation aspect is about the knowledge created which is your knowledge of your practice; the knowledge created is about the knowledge of FM. The research framework is based on the use of the action research cycle; see figure 4. The aim and purpose of such a framework is to help the researcher interpret the precise actions, and map a clear outline to frame the role of FM in a community context. Action research maximized the engagement of the researcher with all the research aspects, and helped him in planning the research into tasks. For example in terms of obtaining knowledge, the critical literature review helped the researcher in contextualizing the interrelationships between the phenomenon under investigation (role of FM), and the social context (the community setting).

Why Grounded Theory

Grounded theory is a strategy which has grown in popularity across a number of disciplines and found its way in recent years into the literature on marketing and management research. Goulding (2007) recommends grounded theory in the case of emerging strategies from practice. Morse (2009) argues that grounded theory allows the researcher to understand phenomena and their attributes within a particular setting. Punch (2005) recommends grounded theory to be applied in the researches where no sufficient theories exist. The rational for using grounded theory usually emerges from perspectives that require the researcher to focus upon developing theories. These

theories provide explanations that are recognizable to the subject of the research (Graham & Thoms, 2008).

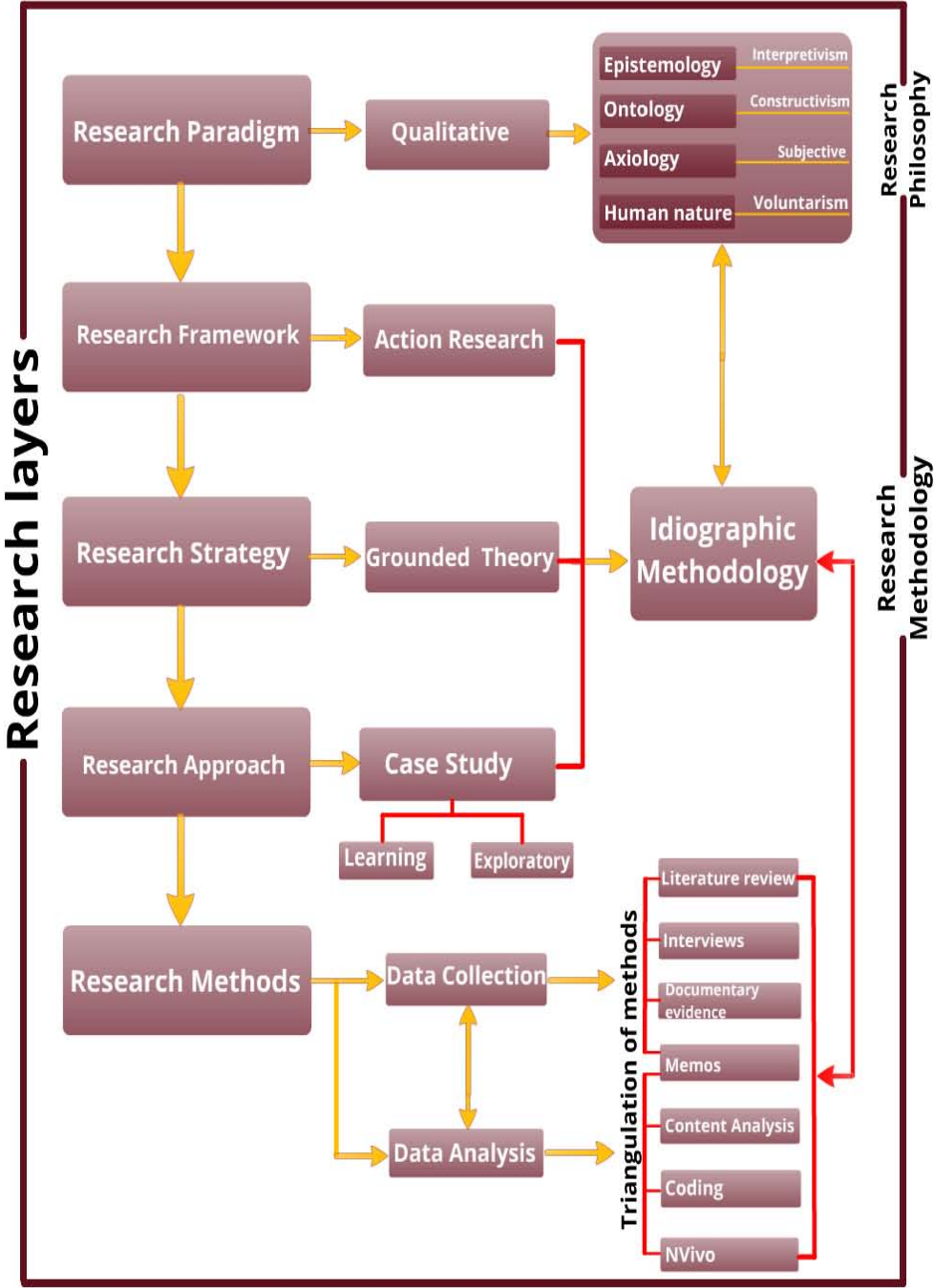


Fig. 3. The research philosophy and methodology

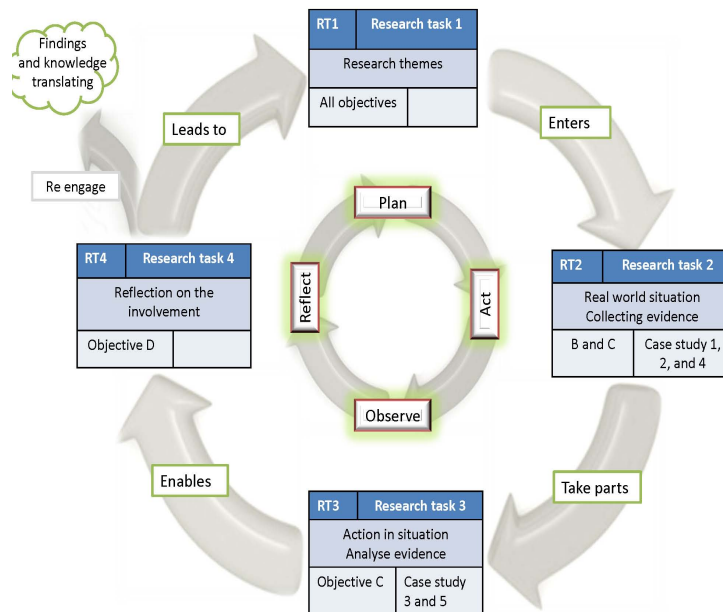


Fig. 4. The research framework and design

McAdam *et al*, (2008) introduced grounded theory as inductive research appropriate to theory building and ‘theory driven empirical research’. Grounded theory enables the researcher to undertake an open approach; and has emerged as the most commonly used methodology in qualitative research (Thomson S. B., 2011). Grounded theory is considered as a philosophical way of thinking based on inductive qualitative research (Morse, 2009; 1994; Goulding, 2007; McAdam *et al*, 2008). Constructivist grounded theory utilizes an inductive, emergent, and open-ended approach. In this approach, the researcher can construct theory from his involvement in the real world, more specifically from his interactions with people and their perspectives (Charmaz, 2005; 2006; 2009; 2011).

As discussed earlier, the research paradigm embeds a social constructivism approach with idiographic orientation. Denzin & Lincoln (2005a) addressed that findings of such paradigms are usually presented in light of grounded theory. Therefore, to develop the principles of FM in the community setting, grounded theory is the most appropriate research strategy because of its primary focus on generating theory directly from the conducted data. Understanding of the knower and knowledge relationship is used to draw meanings and theories around the impact of FM in the community context; leading to the identification and contextualization of the role of FM in sustainable communities.

Why Case Study

Case study is defined as an “empirical inquiry about a contemporary phenomenon, set within its real world context especially when the boundaries between the phenomenon and context are not clearly evident” (Yin, 2009, p. 18). In this research, the relationships between the phenomena, facilities management, and the context of community development and regeneration are not clearly evident. Therefore, case study approach was chosen due to its appropriateness to meet the research aims and to

interact with organisations in order to investigate the role of FM in the community setting.

Gagnon (2010) discusses that in conducting case study, the researcher should subscribe to a constructivist philosophy. Stake (1995) and Yin (2003) base their approach to case study on the constructivist paradigm. The advantage of this paradigm is the recognition of the importance of the subjective creation of meaning without rejecting some notion of objectivity (Baxter & Jack, 2008). The compatibility, between the idiographic nature of the research and the use of case study approach, is nested in their attempts to understand phenomenon in its context, which makes this approach the most appropriate for this research. Combined with grounded theory, case study approach covers all the contextual conditions that are relevant to FM in the community setting, and recognizes the applicability of FM phenomenon in different types of community.

In case study approaches, the researcher should consider what type of case study will be conducted. The case study typology can be defined, once the researcher defines the research problem and identifies the object of the study. The adopted typologies for the purpose of this research are exploratory and learning. It is exploratory because the research attempts to understand a phenomenon, the role of FM in community settings; and learning because the researcher attempts to collect the constructive lessons in order to generate a guide for principles of FM in the community setting.

Data Collection and Analysis

In this research, methods of data collection and analysis emerged from constructivism, grounded theory, and case study. Grounded theory methods are qualitative research methods that use systematic set of procedures to develop inductively derived theory about phenomenon (Strauss & Corbin, 1990). Methods of data collection refer to the tools and techniques utilized for collecting the research data (Bryman & Bell, *Business Research Methods* 2nd (ed), 2007). In grounded theory, data analysis begins almost immediately even during the literature review stage. This analysis entails the researcher developing categories to classify the data and then collect more data which are subsequently classified (Miles & Huberman, 1994). For the purpose of this research, methods of data collection and analysis include interviews, document review, memos, content analysis, and coding preceded by an employed sampling strategy.

Coyne (1997) argues that sampling has a profound effect on the quality of the research, and sampling procedures in qualitative research are not rigidly prescribed as in quantitative research. Sampling is part of the process of data collection and analysis and has an effect on the quality of the research (Goulding C. , 2007). This research contains two types of samplings, namely: purposeful and theoretical. Sampling is purposeful when it is based on some characteristics of the sample, and it is theoretical if the samples were chosen to inform the developing understanding of area of investigation (Coyne, 1997). Table 1 shows how the purposeful characteristics used to define samples of case studies.

Sampling is seen to end when saturation is achieved (Creswell, 1998; Charmaz, 2006; Corbin and Strauss, 2008). The researcher proceeds in gathering more and more data until the theory remains unchanged, and no additional themes emerge from the data (Ryan and Bernard, 2004; Urquhart, 2013). In the context of this research, theoretical

saturation has been achieved when the fine-grained themes, which are related to the phenomena under study, have been sought both during the investigation and validation processes.

Table 1: sampling strategy of case study identification

The purposeful characteristics of the sample				
No	Sampling model	Organizational category	Management theme	objectives
C1	Open and relational sampling	Community organisations	Residents lead	Social
C2			Properties lead	
C3			Community regeneration	
C4			Institutional	Economic
C5			Institutional	

Literature Review

Literature review is a reflective evaluation and critical synthesis of previous research and published works that should logically identify the knowledge gaps and lead to the research questions. The researcher used this to build up an understanding of the theoretical background of the research's scope in two ways. The first was to understand the principles that underpin the current standing and thinking of FM. The second was to comprehend and identify the current state of FM in community settings.

Document Review

Denzin & Lincoln (2005a) consider the use of documents that are in public domain as a data source within the interpretive paradigm. However, not only documents that are in public domain were reviewed, but also confidential documents that were provided to the researcher by case study organisations. Bryman & Bell (2007) recognize documents as a source of information that may have a bearing on the investigation. Documents can be written or unwritten sources of data such as internal reports, white papers, databases, communications tools (emails, memos), and videos (Collins, 2010).

Memos

“Memos are the ideas which will help the researcher in reorientating the research, and have been noted during the data collection “(Goulding, 2007, P 65). Memos are theoretical notes taken by the researcher during and after the data collection about the data and the relationship between categories (Holton, 2007; Corbin & Strauss, 2008). They can be used for both data collection and analysis. The use of this type of data source helps the research to map out the emerging theory. Memos are used to identify concepts and their properties, they are vital as they provide bank of ideas which can be revisited. The memos taken by the researcher during data collection helped in identification of new sources of data especially during the interviews. Memos in data analysis lead to networking between different codes and categories.

Interviews

Interviews are one of the most used and widely accepted methods of data collection. They are preferred in many forms of qualitative research, because of their ability in illustrating findings and supporting the developed research (Goulding C. , 2007). In this research, semi-structured interviews are used because they are more realistic in terms of guiding the conversation with key questions. The potential is located in the flexibility of this form in which the discussion might lead the researcher into areas directly relevant to the research, but not previously considered.

Ethical aspects of the research were considered in that all respondents consented to their participation in the research. All interviewees received, prior to the interview, a copy of research information sheet, consent form, and the interview questions. They were aware of the research objectives through the information sheet and all have agreed to participate in the research, and agreed to the recording of the interview, only few of them asked to keep their names anonymous. Hence, an anonymity code was implemented, in which every interviewee has assigned to a code that designates their individual. Afterwards, all the interview's audios were transcribed by the researcher and prepared for the data analysis.

Interview transcripts play a central role in the research for their importance in analysing, coding, and categorizing the data. Transcripts enable the researcher to focus efficiently on the collected data (Edwards, 1993). Therefore, the researcher should read the interview transcripts a few times in order to build a comprehensive understanding of the occurring phrases and to distinguish between different interviews (Miles & Huberman, 1994). In addition to memos, other data analysis tools utilized in this research are content analysis and coding

Content Analysis

Content Analysis is a tool or research method that has been used to determine the presence of certain terms or concepts within the context of the research. It can take either qualitative or quantitative approach (Stockdale & Standing, 2002). Qualitative content analysis is "a research method for the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh & Shannon, 2005, p.1278). Three different types of content analysis were identified, namely: conventional, directed, and summative content analysis (Hsieh & Shannon, 2005). For the purpose of this research, conventional content analysis is used and codes are derived from data. Coded data enabled the researcher to emerge themes which helped in understanding the relationships between emerging evidence.

Coding

Coding refers to the labeling of data to codes, which are terms to convey meaning (Oktay, 2012). In qualitative research, coding is the creation of categories from interpretation of the data. In the context of this research, the researcher used three coding types namely are: open, selective, axial, and the conditional matrix. Open coding is the first step in the coding process and it entails the researcher to examine the interview transcripts' text (Leedy & Ormrod, 2012); then breaks down the data into segments, scrutinizing them with commonalities within the data that reflect categories (Corbin & Strauss, 2008). Line-by-line analysis is used in which every line

of the interview transcripts were searched for key words. Selective coding is the stage when coding is limited to only those categories related to the core category (Glaser, 1978) cited in (Urquhart, 2013). Therefore, research's coding turns to selective when the researcher begins to identify the core category (Holton, 2007). Conditional matrix is a manner of providing a visual representation of the phenomenon under investigation (Strauss & Corbin, 1998). For the purpose of this research, NVivo 9 was used on two levels: the first was to analyse individual case studies, and the second level was to draw a cross analysis of the five case studies.

Research Reliability and Validity

Research reliability and validity are central concerns in quantitative and qualitative researches (Klenke, 2008). Researchers have referred to reliability and validity to demonstrate the goodness and quality of their researches (Daymon & Holloway, 2011). The use of reliability and validity in qualitative research offer researchers effective means for evaluating their research quality, and if possible in detailed protocol (Kvale & Brinkman, 2009; Creswell, 2009; Maxwell, 2005; Sliverman, 2010). The framework of this research considers all aspects of validation including monitoring the progress of the research according to the plan. The methodological approach is assessed against similar investigations of new phenomena. Interview data is subject to the review and confirmation of the interviewees which addresses the issue of external validity. Reporting case studies provides another tool of external validation as the reports are subject to review and validity by the studied organisation.

Triangulation

Triangulation refers to verifying facts through multiple data sources (Klenke, 2008). Triangulation “entails using more than one source of data in the study of social phenomena” (Bryman, 2004, p.275). This is clearly undertaken by the researcher through the sampling strategy and the selection of different case studies with different themes of communities. Methodological triangulation is the use of two or more methods in the same study such as interviews, observation and documents (Denzin, 2009). In this research, methodological triangulation is achieved by the use of different methods of data collection namely: literature review, interviews, documentary evidence, and case study review as depicted in figure 3.

Conclusion

FM, as we can see, is a multidisciplinary area with complex dynamic systems in operation. Translating this into a community based, with its own complex dynamic systems necessitated looking beyond the traditional methods of research in FM. Critical analysis proved that one of the added values to the research is building a philosophical understanding of the research stances. The adopted idiographic methodology brought together different layers of the research. Within each layer, the researcher clarified the research position. Layers of the research are essential in terms of determining the philosophical orientation of the research, research framework, strategy, and approach. The instrument of primary data collection was interviews supplemented by document review, memos, and literature review. Data analysis involved a triangulation of content analysis, interview transcripts, and memos supported by the use of computer software NVivo. These instruments addressed the

key issues of qualitative research including reliability, validity, and triangulation. Conclusions of this research drew key lessons, namely are:

- The context has big influence on the methodology selection; researchers should select their methodologies according to context's simplicity, complexity, or any other factors that have impacts on the context.
- Understanding the inter-relationships between philosophy and methodology of the research play an important role in the design of the research framework.
- The complexity of knowledge transfer needs a balanced methodological approach and a balanced approach to the research process.
- Data collection and analysis should be built on the principle of the adopted methodology.
- Idiographic methodology along with the context informs the use of grounded theory, in that the realm of knowledge can be expanded.
- The use of grounded theory enables the researcher to follow the path provided by current research rather than the path provided by previous research.

Finally, as discussed above a research with idiographic methodology can be a practice of questioning what you do and a systematic examination of the observed information to find answers and formulate and develop new theories.

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The Preliminary Findings of the Causal Factors of the Interpersonal Conflict

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Abstract

Recently organisations have become more complex and diverse in responding to globalization and to internal and external changes, and this makes them more vulnerable to different types of organisational conflict. One survey showed that managers spend more than 25% of their work time dealing with conflict. Therefore, conflict within organisations has received considerable attention in academia and industry. However, there is a lack of empirical studies on the subject of the factors causing interpersonal conflict (IPC) in countries around the world and most of what has been written are theoretical studies. Further to this background a research methodology has been designed to answer the main research question ‘what are the factors causing IPC in the Libyan cement industry?’ In addition, this paper will focus on presenting the preliminary findings from the inductive data that has been obtained from 48 semi-structured interviews, documents and direct observation.

Keywords

Interpersonal conflict, organisational conflict, conflict management, cement industry, Libya.

Introduction

Conflict is one of the aspects of human interaction. Therefore, conflict in organisations is an inevitable and unavoidable occurrence and has a negative outcome on the individual and the organisation, unless properly managed (Wood et al., 2010; Tjosvold, 2008). In addition, these conflicts take up a lot of managers’ time at all managerial levels (Brooks, 2009; Luthans, 2008; Slocum and Hellriegel, 2007; Hitt et al., 2006; Al-Nimr, 1994). This idea is supported by Hitt et al. (2006: p. 436) who stated that

“One survey showed that managers spend approximately 25% of their time dealing with conflict. In some fields (such as hospital administration and management of municipal organizations), managers can spend as much as 50% of their time managing conflict. Managers rate conflict management as equal to or higher in importance than planning, communication, motivation, and decision making”

Thus, many author have confirmed that conflict in all its different types in organisations is an important topic to focus on; that its importance increases over time (Luthans, 2008; Almusdy, 2007; Hitt et al., 2006; Hellriegel and Slocum, 2004), and that this may be due to the rise of globalisation and interdependence. The negative effects of conflict may deprive an organisation from achieving its goals, may waste time and effort and can lead to a low quality of work (Hitt et al., 2006). On the

contrary, sometimes conflict has positive effects and this might lead to improved problem solving or decision-making, to the stimulation of creativity and may increase productivity (Hellriegel & Slocum, 2004). This positive aspect of conflict depends on how it is controlled and managed (Tjosvold, 2006; 2008; Almusdy, 2007; Hatch, 2006; Adomi & Anie, 2006).

Commonly, most authors divided OC into four types: intrapersonal, interpersonal (IPC), intergroup and interorganisational conflicts. This paper focuses on the second type of OC. The justification for choosing this type of conflict, and not the other types, will be addressed in the next section. IPC is a conflict that occurs between two or more individuals and identifying the factors causing conflict in any organisation is one of the most important stages of the process of conflict management. This idea has been supported by many scholars as Robbins and Judge (2008), Schermerhorn et al. (2005) and Rahim (2002).

Justification for Studying Interpersonal Conflict

The purpose of choosing IPC and not any other OC to study is because individuals are the main element in any organisation and without them organisations cannot exist. Newstrom (2007) stated that IPC is a serious problem for many people because it deeply affects a person's emotions. Also, Wood et al (2010) argued that IPC is a major form of OC that managers face, given the highly interpersonal nature of the managerial role. Moreover, this type of conflict can spread rapidly among individuals within organisations and its negative outcome has a strong influence on the parties involved in the conflict if it is not controlled (Rollinson, 2005). Adomi & Anie (2006) mentioned that IPC involves a relationship in which a sequence of conditions and events moves toward aggressive behaviour and disorder if not properly managed. Due to these elements, this paper will focus on studying the factors that cause IPC in the Libyan cement industry.

The Libyan Cement Industry and the Research Problem

The Libyan cement industry has two companies: The Ahlia Cement Company (ACC) and the Libyan Cement Manufacturing Joint Venture Company (JLCC).

ACC was established in 1965 as a public organisation under the name "Cement and Construction Materials Company". In 1988 it was renamed as the Arabian Cement Company. In 2005 it moved from the public sector to the private sector as a share holding company under the name 'Ahlia Cement Company'. It has six plants: El-Mergeb (in Al-Komes); Suk Elkamis (in Tripoli); Lebda (in Lebda); Zliten (in Zliten); a bags plant (in Al-Komes) and Alklata (in Tripoli); all of them are located in the western region of Libya (ACC, 2011).

JLCC was a public company under name of the Libyan Cement Company (LCC). In 2006 it changed to a private company as a share holding company. It was controlled by the Economics Social Development Fund (ESDF), where 90% of the company shares held by ESDF (which is a unit of the Libyan Government) and the employees had 10% of the shares. This was according to Gaddafi's instruction which was guaranteed in his 'Green Book' under the slogan of 'Employees are partners not Earners'. Based on this slogan all the Libyan employees who work in industry sector have a right to 10% of their companies' shares). Since 2008 the Libyan Cement Company Incorporated has been under the new management of the Libyan Cement

Manufacturing Joint Venture Company (JLCC) that was established as a newly formed Libyan company by the Economics Social Development Fund (ESDF) and the Austrian based Asamer Group to support the development of Libyan cement industry.

JLCC started production in 1972 with one factor but it now has four plants; the Benghazi plant produces 800,000 tonnes of cement a year. The Hawari plant, which was established in 1978, produces a total of 1,000,000 tonnes of cement per year. The third factory is the El-Fatayah factory which was established in 1982 with two production lines that have a 1,000,000 tonne production capacity of ordinary Portland cement each year. LCC also has a factory that produces cement packaging which was established in 1975 in Benghazi city and produces 200,000 bags per day (LCC, 2008).

The Libyan Government (GPC, 2008) has stated that the production by the Libyan cement companies still does not cover the local Libyan market. Moreover, Alferjany (2004) argued that the Libyan cement companies have suffered, and are still suffering, from the phenomenon of conflict either between individuals, groups, departments and organisations. Thus, the factors that cause all types of OC in the Libyan cement industry need to be studied in greater depth.

The Libyan cement companies have consistently faced managerial, technical and financial problems which has lead to low productivity (IGB, 2001; Binsaoud, 2002). Based on the perceived relationship between productivity and conflict in organisations, this may be one of the managerial problems that has caused low productivity. Therefore, this research will focus on studying the factors causing IPC in the Libyan cement industry.

The Importance of the Study

The subject of the identification of the factors that cause IPC is considered as one of the most important topics to be investigated because these factors are considered to be one of the main stages in the process of conflict management (Wood et al., 2010; Al-Rajhi, 2008; Hitt et al. 2006, and Rahim, 2002). Moreover, Elmagri (2001) recommended that the factors causing IPC needed to be studied in Libyan organisations. This idea was supported by Alferjany (2004) who suggested that the factors of OC needed to be investigated in the Libyan cement industry in particular.

Moreover, there is a lack of empirical studies on subject of the factors that cause IPC in countries around the world and most of what has been written as theoretical studies. As far as the researcher is aware, there is no study up until now addressing the factors that cause IPC in the Libyan organisations in general and in the Libyan cement industry in particular. Therefore, this research is expected to add knowledge to, and shed more light on, this environment.

Research Aim and Objectives

This inquiry is part of on-going PhD study that aims to 'Identify the Factors that cause IPC in the Libyan Cement Industry'. The objectives of this study are:

- To review the relevant literature on the concept of IPC to create and understand the causal factors of IPC;
- To conduct an empirical study in the cement industry in Libya;
- To identify the level of IPC in the Libyan cement industry;

- To create a validated framework to the factors that cause IPC in the cement industry in Libya;
- To provide an explanation of these critical factors and their sources in order to provide recommendations to the administration of the cement industry in Libya for their reduction.

Research Questions

The purpose of the on-going PhD study is to answer the following questions about the factors that cause IPC in the Libyan cement industry:

- What is the level of IPC in the Libyan cement industry?
- What are the factors that cause IPC in the Libyan cement industry?
- Why do these factors exist in the Libyan cement industry?
- How could these factors be reduced?

However, the researcher would like to point out that the preliminary findings will be discussed in this paper and it will focus on answering the second question.

Summary of the Main Findings from the Literature

The main findings from studying the literature can be summarised in two points. *Firstly*, the literature has revealed that there is a lack of empirical studies on the topic of the causal factors of IpC in countries around the world and most of them were theoretical studies. *Secondly*, the factors causing IpC can be restricted in a list of twelve elements as following (for more details see Elmagri and Eaton, 2011):

- Individual differences: everyone thinks, feels, looks, or acts alike, and some people simply rub us the wrong way, and we cannot necessarily explain why, personality differences can also cause conflict as well as different values and beliefs (Newstrom, 2007);
- Threats to status: the social rank of a person in a group is very important to many people in any organization. Therefore, when they feel that they will lose their status, they become a powerful driving force and struggle to maintain a desired image (Ibid);
- lack of trust: every continuing relationship requires some degree of trust that opens up boundaries, provides opportunities in which to act, and enriches the entire social fabric of an organization (Ibid);
- Incivility: workplace incivility occurs when employees fail to exhibit concern and regard for others or -worse yet--disrespect each other on the job (Pearson and Porath, 2005). Lack of consideration can appear in many forms, including brusque greetings, sarcasm, failure to return borrowed supplies, selfishness, showing up late for appointments, untidiness, noise (such as playing a radio loudly). Workplace incivility can cause tensions to rise, anger to grow, and conflict to emerge (Newstrom, 2007).
- Limitation of resources: all organisations have limited resources and attempt to find the most efficient way to divide the resources and accomplish tasks.

One study found that competition for limited resources often leads to negative conflict (Hitt, et al., 2006);

- Unfair treatment: Some organisations have a strong status difference between managers and non-managers (employees). For example, managers have flexible schedules, personal telephone calls allowed at work, and longer lunch hours which are not available to other employees. This may lead to resentment and conflict;
- Role ambiguity: when an individual does not have adequate information on the nature of the work required of him in the organization or when he has a lack of of determined competences or lack of defined responsibilities. This may lead him into conflict with others;
- Role incompatibility: in this situation conflict occur when an individual finds himself do more one role which include incompatible goals;
- Organisational change: with the pace of technological, political and social change increasing and the marketplace hurtling toward a global economy. Organisational changes will be over-present and then conflict will exist (Newstrom, 2007);
- Contradiction of goals: out of necessity, organisation members frequently pursue goals that are somewhat different from one another and they are sometimes incompatible or contradiction, thus setting the stage for potential conflicts;
- Information deficiency: This source of conflict results from communication breakdown in the organization. It may be that the two employees in conflict are using different information or that one or both have misinformation. This source of conflict is not emotionally charged and after corrected, there is little resentment (Luthans, 2008);
- Organisational environment stress: it is more likely that conflicts will occur in organisations that are characterized by a lack of resources, by downsizing, competitive pressures, by high degrees of uncertainty (Ibid).

Research Methodology

The main purpose of research methodology is to explain how the research questions will be answered. It refers to the choice and use of a particular philosophy, an approach, strategies and tools for data collection and analysis.

The ontological philosophy of this study is idealism which refers to the fact that reality is not one objective but it is constructed by people differently. The interpretivism was selected as the main research philosophy that because the current study is focusing on meaning rather than measurement. The nature of this study is theory building rather than theory testing and this study intends to develop a theory inductively from data collection and analysis. Consequently, the inductive logic has been selected as the logic of this research.

In the literature there are two main approaches to collect data: quantitative and qualitative approaches. Due to the nature of this study which focuses on employees' experience and behaviour in the Libyan cement industry in the area of IPC and to the

philosophy of this study. The qualitative approach is the most suitable one for this study.

According to Yin (2009), case studies are the preferred strategy when “how” or “why” questions are being posed, when the investigator has little control over events and when the focus is on contemporary phenomena within a real-life context. Thus, a case study research approach was chosen as appropriate for studying such a social setting.

A case study can be conducted in one organisation (a single case study) or in more than one organisation (multiple-case studies). Yin (2009) argued that researchers, who prefer to adopt a single case study as a research strategy need to have a strong justification for this choice. As a result of this consideration, a multiple case study approach was decided as an appropriate research design for the present study. As mentioned in section 4 the Libyan cement industry has two main companies working in this area, the ACC and the JLCC, both companies were utilised as cases studies in this research to gain an in- depth understanding of the phenomena.

The multiple-case studies strategy has two types of design: multiple holistic case studies which involve a single unit of analysis and multiple embedded case studies which involve multiple units of analysis (Yin, 2009). In this study, multiple embedded case studies were selected. This will involve multiple realities at senior, middle, shop floor management and ordinary workers which could provide data to enrich the findings. Details of the units of analysis are given in table (1).

Table 1: The units of analysis

Organisational level	Identification details
Top management (TM))	Senior managers and deputy managers
Middle management (MM)	plants managers and departments managers
Shop floor management (SM)	Supervisors employees
Ordinary Workers (OW)	Workers in the headquarters and plants

The present study combines face-to-face semi-structured interviews, direct observation and the examination of documents, aiming to benefit from the strengths of each method in order to obtain a wide variety of data, as well as gaining an in-depth understanding of the subject.

Table 2: The target interviewees

No	Organisational levels	ACC	JLCC	Total
1	TM (Senior managers and deputy managers in the headquarters)	2	2	4
2	MM (plants managers and departments managers)	6	4	10
3	SM (Supervisors in the headquarters and manufactories)	7	7	14

4	OW (Ordinary Workers in the headquarters and manufactories)	10	10	20
	Total	25	23	48

The total number of interviews undertaken was 48 in the two case studies: 25 in ACC and 23 in JLCC. Table 2 presents the target interviewees of the study in more detail. All interviews were conducted between July 2010 and October 2010. The duration of each interview varied between thirty minutes and an hour.

The main challenge for qualitative data analysis is how the large amount of data which is gathered from different sources can be summarised and structured to arrive at meaningful conclusions. However, Braun and Clarke (2006) argued that thematic analysis offers an accessible and flexible approach to analysing qualitative data especially for students and those not particularly familiar with qualitative research, as it provides core skills that will be useful for conducting many other forms of qualitative analysis.

Therefore, the data was analysed by using thematic analysis (which some authors, such as Collis and Hussey 2003; 2009 call it general analytical procedure). It can be analysed through identifying patterns or themes, coding, categorising, summarising and interpretation. The analysis was organised in two stages: within-case analysis and cross-case analysis, which were recommended for multiple case study research by Ayres, et al. (2003), Creswell (1998) and Yin (1994).

Preliminary Findings

During the analysis of the qualitative data major themes came forward as follows: The nature of IPC; the level of IPC; the indicators of the existence of IPC on this level; the causal factors of IPC; and reduction of the factors causing IPC.

The main question of this paper is ‘what are the factors that cause IPC in the Libyan Cement Industry?’ and this present paper seeks to answer this question. Therefore, this paper will focus on presenting the preliminary findings of the fourth theme only, ‘the causal factors of IPC’. The preliminary findings of this study showed that the factors causing IPC can be represented by the following factors:

- Individual differences: especially cultural differences and the age gap between employees;
- Threats to status: this emerged from some participants’ expressions such as *‘when I was appointed in this department, I faced many irritations from some employees because they thought that I would threaten their position in the department’*
- Incivility: that appeared in the term ‘members who agitate and cause disturbances’;
- Limitation of resources: which was represented by limited training;
- Unfair treatment in the distribution of wages, rewards and training;
- Role ambiguity: that emerged from some interviewee expressions from JLCC such as *‘in our department we do not have specific job for each one where anyone can do the work’*. JLCC were still preparing the organisational structure of the company and job descriptions after the LCC integration with

the Austrian Asamer Group whereas ACC had not updated its organisational structure and job descriptions since 1989 (seen by reviewing documents);

- Role incompatibility: that represented a clash between the family role and the job role of employees. For example, one respondent argued that *'most employees needed to collect their children from school between 1.00pm and 2.00pm and they have a job at the same time. This can put the person in trouble with his boss or colleagues'*. This problem is considered one of the most common problems that facing Libyan society because of a lack of public transportation. This problem was also highlighted by Elorafi (2010) who confirmed that most Libyan employees in Libyan organisations had the problem of collecting their children from school during work time;
- Organisational change: which appeared strongly in the responses of the JLCC participants;
- Information deficiency: it represented in lack of work meetings;
- Organisational environment stress: it was confirmed by an inconstant organizational structure of the two companies;

All the above factors were confirmed by what was found in the literature. However, the interviews with respondents also revealed that there are some other factors that cause IPC which do not exist in the literature and which can be considered as unique factors (see table 3). They are:

The factors that cause IPC	In this study	In the literature
Individual differences	X	X
Threats to status	X	X
Incivility	X	X
Limitation of resources	X	X
Unfair treatment	X	X
Role ambiguity	X	X
Role incompatibility	X	X
Organisational change	X	X
Information deficiency	X	X
Organisational environment stress	X	X
Contradiction between the organisation's policy and the state laws	X	
Mismanagement	X	
Tribal bigotry	X	
Contradiction of goals		X
Lack of trust		X

Table 3: A comparison of the factors causing IPC that found in this study and those found in the literature

- Mismanagement: one of the participants from the ACC stated that *'most units and departments need to pay attention to the administrative and organisational side, not just to the technical side as happens now. In other words, the company needs to put the right man in the right place, based on administrative and technical abilities not on tribal referentiality'*. The mismanagement of the organisational change was very clear in the JLCC, where all respondents confirmed that they were not informed about the merger process and it surprised everyone. Also, they confirmed that the integration between the two companies had been agreed by the Libyan government in order to improve the production rates of goods and to receive tangible benefits from foreign expertise;
- The tribal bigotry: For example, one respondent argued that *'one of the factors contributing to conflict, from my point of view, was because some employees dealt with others in an arrogant manner because they were from a large tribe or because they felt that their tribe had social status. This behaviour could lead to tension and resentment between the parties which may result in strong conflict between the parties for trivial reasons'*;
- Contradiction between the organisation's policy and the state's laws: four of the JLCC respondents (two from the TM and the other two from the MM) explained that JLCC suffers from the fact that the policy of the company contradicts with some Libyan laws such as Law Number 15 of 1981 which prevents giving Libyan employees a salary of more than 750 LD for the purpose of achieving social justice amongst all the segments of society.

In addition, from table 3, there are some factors found in the literature but not found in the study, like contradictions of goals and lack of trust. All the observations will be interpreted in the thesis.

Expected Contributions to Knowledge

There is a lack of empirical studies on subject of the identification of the factors that cause IPC in countries around the world and most studies have focused on managing IPC and OC. Thus, the main contribution to knowledge by this study is to fill the gap in the literature on the subject of the factors that cause IPC by conducting an empirical study in the Libyan environment. As far as the researcher is aware, this study is the first conducted in the Libyan context where no previous empirical research has been undertaken to investigate the factors of IPC in the Libyan environment. It is, therefore, an original study in this area. The main contribution to knowledge that was found in this study was the identification of three unique factors causing IPC in the Libyan cement industry. These factors have not been mentioned before in the literature, as explained in section nine.

Conclusion and Further Research

This paper has tried to provide an answer to the main question of on-going PhD study 'What are the factors that cause IPC in the Libyan cement industry' by analysing qualitative data that came from 48 face-to-face semi-structured interviews, from direct observation and documentation, and by using multiple embedded case studies as the main research strategy (at the senior, middle, shop floor management and the ordinary workers within ACC and JLCC). The data was analysed by using a thematic analysis.

The main preliminary findings of this study showed that individual differences, threats to status, incivility, limitation of resources, unfair treatment, role ambiguity, role incompatibility, organisational change, information deficiency, organisational environment stress, mismanagement generally and mismanagement of organisational change particularly, tribal bigotry and the organisation's policy where it contradicts with the state's laws are the main factors that cause IPC in the Libyan cement industry.

Due to the different Libyan environment, both culturally and politically, it has been found that three unique factors also cause IPC in the Libyan cement industry and this discovery is the main contribution to knowledge by this study.

Finally, the researcher recommends other scholars to study, as a theoretical or empirical study, the other factors that cause OC, such as identifying a list of factors causing intrapersonal conflict, intergroup conflict and interorganisational conflict which, in turn, can give opportunities to many researchers for further study on managing each different kind of OC.

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Understanding the Concept of Outsourcing for Facilities Management (FM) Services Using Structural Equation Modeling (SEM)

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Abstract

A major trend in the business world today has been to concentrate on core competencies and outsource non-core services in order to improve organisational efficiency and effectiveness. As a way of keying into this trend, organisations within the property industry domain are vigorously reforming and reorganising their facilities management services provision by changing job description of in-house facilities management staff from routine purchasing tasks to more strategic roles that support the overall goals of their organisations. However, in doing this, there must be a balance between motives for outsourcing and inherent risks involved. This study presents a theoretical framework on how structural equation modeling (SEM) methodology is used to analyse a major component of outsourcing – outsourcing decision as it relates to facilities management services provision. Specifically, the study as part of an on-going research explains how SEM approach is used to model both direct and indirect relationships between outsourcing decision variables associated with FM outsourcing and its impact on level of outsourcing among organisations. The study also contributes to the methodological construct by describing the application of SEM for analysing complex interactions of latent factors within the property industry domain, and puts forward justification for SEM in preference to other techniques currently being used.

Keywords

Facilities, Measurement model, Structural model, Make or buy, Decisions.

1. Introduction

It is generally acknowledged that outsourcing has become one of the most researched areas in management studies due to its rising profile as a management strategy for improving efficiency and effectiveness in the management of resources (Kakabadse and Kakabadse, 2001; Ikediashi *et al.* 2012). On the other hand, FM has over the years established itself as a force to be reckoned with within the property and construction industry domain on account of its new orientation as a strategy that provides high quality, cost-effective, and integrated approach to management of facilities and its related services (Nutt, 2004; Pitt *et al.* 2009). Researchers opine that organisations are keying into this concept of outsourcing by planning and reorganising their FM services provision to reflect changes of in-house FM staff from hitherto routine purchasing tasks to more strategic roles that support the overall goals of their organisations (Ventovuori *et al.* 2006; Jensen, 2008; Jensen, 2011). In other words,

the responsibility for management of FM services is shifting to either the use of specialist partners (Usher, 2004) or the entire package being outsourced to a total facilities management company (Atkin and Brooks, 2009); while service providers have begun to redevelop and rebrand their various range of services as a way of attracting interests from prospective clients.

However, one argues that the trend towards organisational outsourcing particularly in the FM industry imposes the need for use of appropriate decision support system for managing this new era of choices and flexibilities (Ancarani and Capaldo, 2005). There has been a proliferation of studies particularly on IT enabled concept of outsourcing decision (McCarthy and Anagnostou, 2004; Kremic *et al.* 2006; Yang *et al.* 2007; Kumar *et al.* 2010; Schoenherr, 2010). Previous studies have equally used SEM methodology to examine the concept of outsourcing process (Aubert *et al.* 2003; Whitten and Wakefield, 2006; Handley and Benton Jr., 2009; Ren *et al.* 2010). While acknowledging the impact these studies have made in understanding the concept of outsourcing, this paper contends that only a relative handful of studies have specifically examined the concept of outsourcing from the view point of FM services provision (Burdon and Bhalla, 2005; Hassanain and Al-Saadi, 2005; Cigolini *et al.* 2011; Ikediashi *et al.* 2012). Specifically, a clear understanding of how key attributes of outsourcing decision relates to each other from FM perspective is worthy of investigation. This is to provide practitioners and stakeholders in FM profession, insights into what areas that require standardized mitigation measures for achieving outsourcing success.

Based on review of concomitant literatures, this paper uses SEM approach to develop a theoretical framework and a conceptual model for analyzing a vital component of outsourcing (outsourcing decision) as it relates to FM services provision, and put forward justification for adopting SEM methodology. It is part of a larger on-going doctoral research aimed at building an integrated model for outsourcing FM services. The proposed model is expected to integrate key constructs of decision support system and risk management model for outsourcing facilities-related services among organisations.

2. Structural equation modeling methodology

2.1 History of SEM and how it works

Structural equation modeling (SEM) is a multivariate tool developed by Joereskog and Goldberger (1975), and Joereskog (1981) to investigate interrelationships between two types of variables; observed and latent variables while taking into account measurement errors that might accompany the variables (Blunch, 2008). Observed variables, otherwise called indicators or manifest variables are those that possess data that can be directly measured using numerical responses to a rating scale item on a questionnaire while latent variables are those that cannot be directly measured (Blunch, 2008; Hui and Zheng, 2010; Bagozzi and Yi, 2012). It is a perfect technique for analysing causal relationships among endogenous variables (referred to as the structural model in SEM), and between endogenous and exogenous variables (referred to as the measurement model in SEM).

Theoretically, SEM is made up of two models namely: measurement model and structural model. Measurement model assesses how well the variables measure the

latent factors addressing their reliability and validity. In order to establish confidence in the measurement model, series of tests (confirmatory factor analysis-CFA) are conducted to ensure that a feasible model is selected for SEM analysis (Molenaar *et al.* 2000). According to Chinda & Mohamed (2008), CFA allows for assessment of fit between observed and a *priori* conceptualized, theoretically grounded model that specifies the causal relationships between the latent factors and their observed variables. Several authors have suggested best-fit parameters for conducting CFA. Bagozzi and Yi (2012) are of the view that $\chi^2/\text{Degree of freedom}$, Root mean square error of approximation (RMSEA), non-normed fit index (NNFI), Comparative fit index (CFI), and Standardized root mean square residual (SRMR) are the most reliable parameters for assessing the fitness of the measurement model. However, Jin *et al.* (2007) suggest that the strength of the measurement model can also be estimated by conducting Cronbach's alpha reliability test. Others parameters suggested in the literature include Tucker-Lewis index (TLI), Incremental fit index (IFI), and Relative fit index (RFI) (Byrne, 2001; Chinda and Mohamed, 2008; Singh, 2009; Doloi *et al.* 2010). It is important to note that fitness of the measurement model is established before final SEM analysis.

Structural model also known as path model or inner model models the relationships between latent variables by describing the amount of explained and unexplained variance, which predicates system of simultaneous regression models (Wong & Cheung, 2005; Chinda & Mohamed, 2008). In other words, it assesses how well the measurement model fits the data by testing and analysing hypothesized relationships using data generated from a study. There are three main approaches to modeling in SEM. It includes Covariance-based SEM, Component-based SEM also referred to as Partial least square (PLS)-based SEM and Generalized structured component analysis (GSCA). According to Hwang (2010), PLS-SEM and GSCA are similar in nature in terms of latent variable composition, model parameters, input data, estimation method, normality assumption, and model fit measures, while in terms of dissimilarity, there are two equations for PLS-SEM and only one equation for GSCA. Hwang (2010) however considers Covariance-based SEM and Partial least square (PLS)-based SEM as traditional approaches on account of their popularity among researchers while GSCA is known as the alternative method. Several other researchers have concluded that Covariance-based SEM is the best for analysing path coefficients during SEM (Yuan *et al.* 2010; Hwang, 2010; Ringle *et al.* 2012; Hensler, 2012). The authors contend that it is known to recover loadings, parameters, path coefficients, and produces unbiased parameter estimates better than the other two approaches. On the other hand, GSCA is observed to substantially over-estimate direct effect in mediation analysis and is known for producing inconsistent estimates during analysis (Hensler, 2012). This study is based on Covariance-based SEM. The next sub-section puts forward justification for adopting the approach.

2.2 Justification for using Covariance-based SEM

Although Covariance based SEM is widely applied across many academic disciplines, Doloi *et al.* 2012 assert that construction management researchers are yet to fully embrace the methodology. This is despite the benefits compared to other techniques currently being used. For example:

1. It helps researchers to be more precise in their specification of hypotheses and operationalisation of constructs (Bagozzi and Yi, 2012);

2. It models latent variables, specifies and corrects measurement errors and their covariance structures, and also estimates entire theories simultaneously (Hensler, 2012);
3. It models and predicts relationships in a hypothesized model (Ringle *et al.* 2012; Hensler, 2012);
4. It guides exploratory research in a way that combines self-insight and modeling skills with theory;
5. It accommodates dependent variables with multi-dimensional constructs as against other similar techniques such as regression analysis and path analysis;
6. And above all, it is easy to use.

From the view point of construction management research, Islam and Faniran (2005), Wong and Cheung (2005), Yang and Ou (2008), Doloi *et al.* (2011) and Doloi *et al.* (2012) have all demonstrated SEM as a viable methodology for explaining the complex nature of problem variables common in the construction industry. For instance, Islam and Faniran (2005) used SEM to analyse the quantitative influence of project environment and organisational related factors on effective project planning, and concluded that SEM is highly effective in understanding the direct and relative impacts of latent factors on measured phenomena (e.g. project planning factors) in the hypothetical construct (Doloi *et al.* 2012). Also, Yang and Ou (2008) established that SEM can quantify comprehensive relationships among latent variables for resolving problems within the construction industry.

Based on the aforementioned, it is clear that SEM is most suitable for analysing complex multiple interactions within the construction industry and particularly FM industry domain. FM industry is becoming increasingly complex, while the inter-relationship between FM services provision, the decision to outsource, and the inherent risks involved has added more pressure to the issue of sustainable resource management. The next section uses extant literature to develop a theoretical framework for outsourcing decision for FM services.

3. Outsourcing decision for FM services

Outsourcing has been variously defined by researchers as the procurement option that favours “contracting-out” of services previously performed in-house to an external service provider as a mean of increasing organisational efficiency and effectiveness (Li and Choi, 2009; Hamzah *et al.* 2010). Thus, outsourcing involves the contract between an organisation and an external provider for the purpose of contracting out services which were previously performed by in-house staff. In contrast however, there is a school of thought which argues that outsourcing is just the procurement of services or products in order to cut costs (Domberger, 1994). The author contend that the services do not necessarily need to have been previously performed in-house.

This paper adopts a general definition that does not distinguish between what was previously performed in-house and what was never performed by in-house before it is contracted out. Consequently, it defines FM outsourcing as:

“The decision by an organisation to contract out its FM services to an FM services provider at an agreed fee for specified period of time”.

This definition purposely does not differentiate between types of services, provided there are within the confine of facilities management services.

Over the past few decades, numerous studies have highlighted the importance of outsourcing decision factors (Abraham and Taylor, 1996; Lonsdale and Cox, 1997; McCarthy and Anagnostou, 2004; Ancarani and Capaldo, 2005; Burdon and Bhalla, 2005; Ghodeswar and Vaidyanathan, 2008; Kroes and Ghosh, 2010). This section summarises the review of pertinent research with special emphasis on factors that influence decision to outsource and the adopted approaches used in each circumstance.

In Italy, Ancarani and Capaldo (2005) developed a theoretical model to assist public managers in decision making process for facilities management services using a comprehensive review of background literature and validated the framework using semi-structured interview on eight managers involved in Italian LAs FM markets. The model took into account both internal and external variables with reference to FM sourcing strategies applied in local governments. The internal variables relate to operational aspects of the public enterprise such as operations, competencies, complexities and dimension while the external ones relate political and competitive pressures. The model suggests that in-house management prevails when political involvement as well as the need for employment is very high while outsourcing strategy should be adopted when there is competitive pressure, provision of complex services, need for cost reduction and market complexities.

Burdon and Bhalla (2005) examined the outsourcing decision factors in terms of the benefits derivable from outsourcing of Engineering and Facilities Management (EFM) services in Australia using a review of literature and interviews on senior executives of Engineering and FM organisations in Australia. The authors categorized the factors into *primary* benefits (reducing costs, enhancing reliability, improving quality and access to best practice), *secondary* benefits (flexibility to changes, focus on core competencies, achieving innovation and continual improvement) and *nice-to-have* benefits (understanding of business objectives, improving customer relations, improving labour relations, conserving capital and increasing speed to market. In all, the survey shows that cost reduction was the most rated factor while increasing speed to market was the least rated.

Ghodeswar and Vaidyanathan (2008) used mainly literature review of articles on existing theoretical perspectives on outsourcing to classify drivers of outsourcing into organisational, improvement, financial and cost, and revenue drivers. The authors explain organisational drivers as considerations that hint on the organisation's desire to achieve a higher quantum of focus on core business, increase flexibility to deal with ever changing business conditions, demand for products and services, leveraging emerging technologies and achieving higher stakeholder value. Improvement drivers seek to improve operating performance such as obtaining expertise, skills and technologies; improve management control; improve risk management; acquire innovative ideas; improve credibility and image by associating with superior providers. Financial and cost drivers of outsourcing the authors posit are to reduce investment in assets, free-up resources for other purposes and generate cash by transferring assets to the service provider. This they believe will give an organisation the opportunity to reduce or control the operating costs, convert fixed costs to variable costs by allowing service providers to use their expertise to handle complex and very

demanding situations more effectively using economies of scale, automation, process maturity and investment in the latest technology at their disposal. On the other hand, an organisation's desire to outsource, the authors believe, are driven by the need to achieve aggressive growth through gaining increased market access and leveraging the service provider's best-in-class process, capacity and systems. In effect, equipment, facilities, vehicles and licences used in the current operations have a value and are sold to the provider as part of the transaction, resulting in an inflow of cash.

Kroes and Ghosh (2010) used literature review to develop a set of outsourcing decision factors and categorized them into cost related outsourcing drivers, flexibility related outsourcing drivers, innovativeness related outsourcing drivers, quality related outsourcing drivers and time related outsourcing drivers. *Cost* related drivers are those factors that aim to improve cost competitiveness by eliminating unproductive activities and refocusing on reducing costs. According to the study, the specifics include the selection of a partner that offers lower total costs, logistics and regulatory as well as legal costs to perform an activity. On the other hand, outsourcing drivers that support *flexibility* include a desire to increase process innovativeness and the ability to change production volumes and supply chain activities in response to changing market needs. Besides, firms that emphasise on *innovativeness* when making outsourcing decisions rely on it to gain access to labour skills and expertise not available in-house (Hoecht and Trott, 2006) and free up employees with innovative skills and expertise not available to competitors. Also, outsourcing decisions that focus on *quality* as the key priority will want to see how the services of the provider have conformed to quality standard specified in the outsourcing contract better than when it is done by in-house staff. A focus on *time* when making outsourcing decisions implies hiring a provider that will improve product delivery by developing and delivering products on time, offer comparatively faster process capability and reduce cycle times (Kroes and Ghosh, 2010). However the factors developed by the study are majorly private sector-driven while it was carried out on the manufacturing industry. The implication is that non-financial benefits or factors such as environmental and social considerations, customer and labour relations are left out as factors to consider while making outsourcing decisions.

Using data from 335 firms, Aubert *et al.* (2003) proposed and tested a structural equation model of information technology (IT) outsourcing behaviour. The study examined the impact of asset specificity, uncertainty, business skills, and technical skills on outsourcing level. Findings from the study revealed that the need to acquire technical skills is the most important reason to outsource, while business skills do not seem to play any significant role.

There are several models for assisting practitioners in decision making process in the literature. However, Westphal and Sohal (2012) identified decision tree models, heuristic models/portfolio instruments, and scoring models as three main types of outsourcing decision models in the literature. Decision tree models uses tree-like graph to model decision and their possible consequences including event outcomes, resource costs and help practitioners to identify the most suitable strategy to achieve a specific goal. Examples of outsourcing decision tree models include Venkatesan (1992) make or buy decision model that divides between strategic and non-strategic components of an organisation's products or services; Grover and Teng (1993) decision tree model; and McIvor (2000) model that distinguishes between core and non-core activities. Pagell *et al.* (2010) argue that the use of heuristic models has been

widely embraced as an effective tool for strategic sourcing in supply chain management. Proponents of the heuristic models (Kraljic, 1983; McFarlan and Nolan, 1995; Olsen and Ellram, 1997; Bensaou, 1999) contend that easy-to-use heuristics offer the best option of determining when, what, and to whom should services be outsourced. In particular, McFarlan and Nolan (1995) IS portfolio instrument comprises two dimensions namely the current dependence on information and the future importance of computer applications and uses strategic grid to identify core competency and finance, effort of disentanglement, the cultural fit, and avoidance of integrating high-tech staff in a low-tech organisation. Scoring models are mathematical models that provide practical tools for managers while making outsourcing decision (Westphal and Sohal, 2012). The most frequently used scoring models are the analytical hierarchy process (AHP) and preference ranking organisation method for enrichment evaluation (PROMETHEE) (Wang, 2006; Yang *et al.* 2007; Sucky, 2007).

While the intrinsic factors influencing the decision to outsource were clearly identified in the studies above and several other studies, most of the models in the literature are equally useful and currently being used by researchers and practitioners. However, majority of the findings were not useful in articulating any structural pathways explaining the underlying links within the decision factors. Besides, most of these studies failed to examine how decision factors work to influence each other and the level of outsourcing. With the rising use of outsourcing for FM services provision, the quantification of relationships among different motivational factors and how they impact level of outsourcing is certainly an important area worth investigating. The next section discusses how SEM is used to analyse outsourcing decision which is a function of several variables.

4. Conceptual SEM model

The aforementioned studies (McCarthy and Anagnostou, 2004; Ancarani and Capaldo, 2005; Burdon and Bhalla, 2005; Ventuvuori, 2006; Ghodeswar and Vaidyanathan, 2008; Kroes and Ghosh, 2010) provide the theoretical basis to construct a SEM model for the proposed study. It uses structural equation modeling methodology to examine the inter-relationships between outsourcing decision motivators and the level of outsourcing in organisations. The hypothesized model shown in figure 1 uses the methodology adopted by Aubert *et al.* (2003) to examine the direct and indirect relationships between latent constructs of outsourcing decision and their impact on the level of outsourcing in an FM context. The twenty-six (26) items described as motivators were grouped into 5 latent variables. The hypothesized model tests the following hypotheses:

Hypothesis 1: The decision to outsource FM services based on cost considerations has impacted on the level of use of outsourcing for FM services provision

Hypothesis 2: The decision to outsource FM services based on strategy considerations has impacted on the level of use of outsourcing for FM services provision

Hypothesis 3: The decision to outsource FM services based on innovation considerations has impacted on the level of use of outsourcing for FM services provision

Hypothesis 4: The decision to outsource FM services based on quality considerations has impacted on the level of use of outsourcing for FM services provision

Hypothesis 5: The decision to outsource FM services based on time considerations has impacted on the level of use of outsourcing for FM services provision

A quantitative approach has been adopted to test the conceptual model in the Nigerian FM industry context. A questionnaire is currently being designed to capture the observable attributes while respondents who are mainly practitioners would be asked to assess how the 26 measured attributes of outsourcing decision categorized into 5 components have impacted on the perceived level of outsourcing in their organisations.

Owing to number of words restriction for this conference, one of the five hypotheses is briefly explained. Organisations place considerations on the cost related factors (CRF) when they want to improve on their financial standing and cost efficiency. Researchers argue that service provider's lower cost structure enables improved performance through freeing up of resources and the needed funds for other purposes. The impact of cost related factors (CRF) is presumed to be reflected in the observed measures of five variables as CF01 (to make cost transparent), CF02 (to reduce investment in assets), CF03 (to access vendor's cost efficient structure), CF04 (to achieve cost reduction with enhanced performance), and CF05 (to reduce invested capital funds in non-core functions), while the level of use of outsourcing is presumed to be reflected in the volume of FM services outsourced to service providers. The hypothesized model therefore tests the proposition that increased volume of FM activities outsourced is triggered by cost related considerations.

5. Conclusion

FM is gaining increasing popularity all over the globe, with several sourcing strategies springing up for FM services provision while the significance of outsourcing as a strategy for improving performance in sectors including FM has been variously acknowledged by scholars and professionals. As FM becomes complex, it is confronted with a host of direct and indirect factors from different and complex perspectives. For instance, managers and decision makers are increasingly facing issues and challenges in the absence of sufficient and reliable information to make decision.

This paper examined the concept of outsourcing decision using SEM methodology from the point of view of FM services and developed a conceptual model that analyses the relationship between components of outsourcing decision and its impact on level of outsourcing. The hypothesized model is expected to be tested using empirical data from Nigeria's FM industry while the final structural equation model is expected to benefit theory and practice. First, it hopes to avail FM practitioners of the key components of outsourcing decision that is having the most significant impact on the volume of outsourcing activities as well as the least significant decision variables that would require standard mitigation measures. Second, it hopes to add to the current methodological literature on the use of SEM for analysing complex interactions within the FM industry domain.

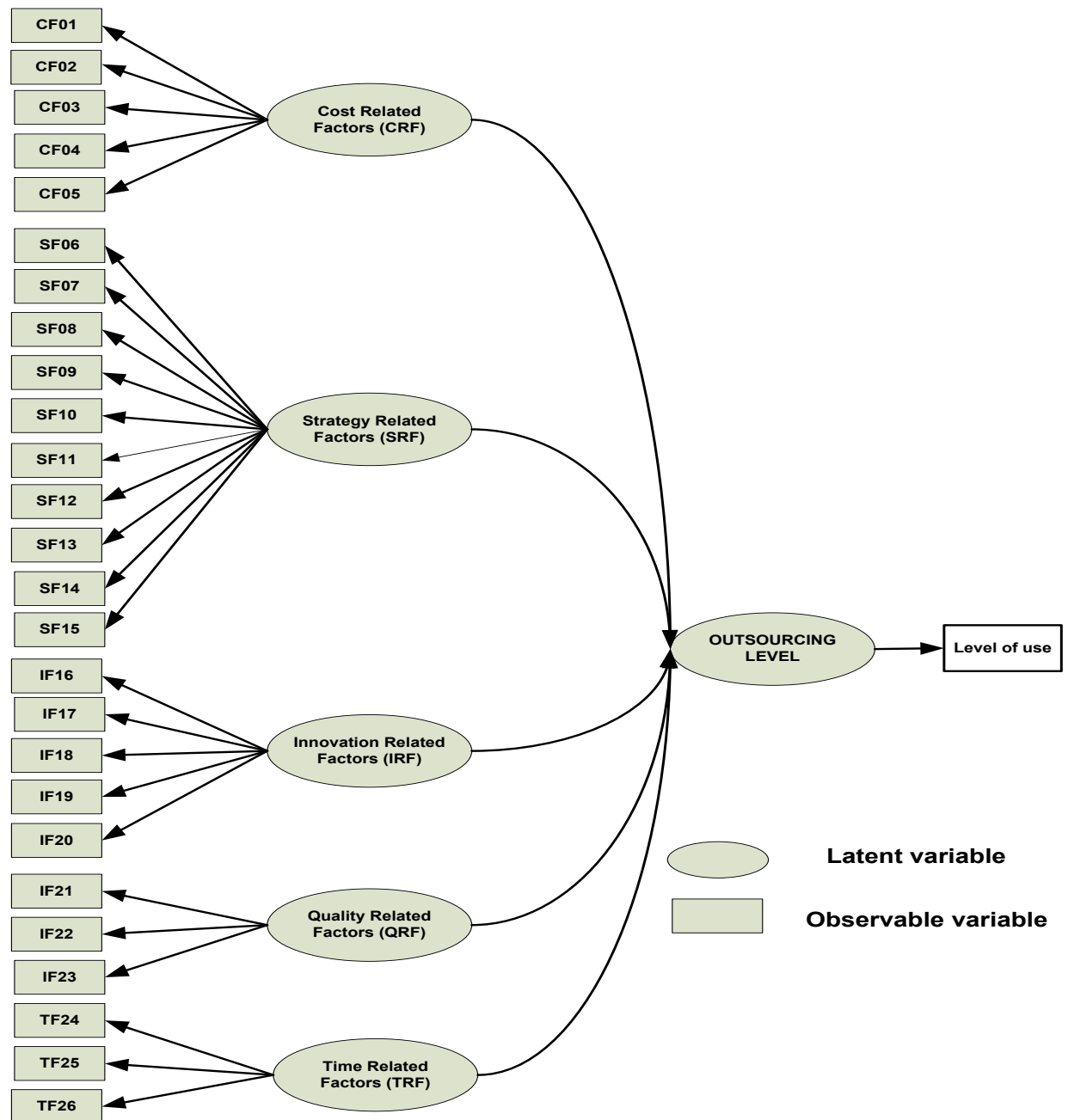


Figure 1 The conceptual Model

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Research Approach on the Environmental Consequences of Steel in Buildings

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Abstract

This paper describes the nature of the doctoral research that the author will be undertaking. It is a project proposal, justifying the research topic, rationale, methodology, method and programme. The focus of the research is on the review of building level assessment methods, compilation of environmental databases and preparation of environmental profiles for use at project inception stages. Both the literature-based and the physical data collection parts of the research fall into a foundationalism approach. The quantitative methodology adopted for this research is constructive research. In order to work within the constraints of this methodology, a computerised analytical survey will be employed to collect data from collaborating UK steel fabricators. Randomisation will be used to establish a representative sample. This paper has highlighted the mammoth challenges ahead but most importantly, it has demonstrated that the research is achievable within the available timescale and resources.

Keywords

Environmental, Methodology, Method, Programme, Research

Introduction

The purpose of this paper is to present a project proposal for a doctoral research that the author is undertaking. This sets a clear topic focus and programme of works, enabling the doctoral research to progress to the next vital stages with confidence.

Section 2 discusses the development of the research topic and the rationale of why this area is considered researchable. The contribution that this research makes to existing knowledge on sustainable development is then considered in Section 3. A large part of the research involves literature-based reviews but physical data will be collected from the United Kingdom (UK) construction industry. In addition to providing the relevant research data, literature reviews facilitate familiarity with the most recent research. This helps to mitigate any weaknesses in the project that may have necessitated the revisiting of later phases, causing significant financial and programme drawbacks. Theoretical approaches, methodology and methods are addressed in the Section 4, highlighting those that will be employed for this research. This is followed by an idealised programme of works in Section 5, showing the various tasks to be undertaken and anticipated timescales.

Rationale

Investigations into the phenomenon of climate change goes back as far as John Tyndall's work of 1858; it is understood as the process whereby some of the sun's rays, radiating from the Earth's surface, are deflected back to the Earth by the greenhouse gases (GHG) in the ozone layer resulting in global warming (Allwood & Cullen, 2012). The majority of gases with two or more different atoms make up the GHG, but the most prevalent are carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O). Owing to CO₂ being the dominant gas, environmental impact is often referred to as the carbon footprint and the inclusion of other GHG emissions is expressed as carbon dioxide equivalent (CO_{2eq}).

This research will focus on global warming and the need for the sustainable use of natural resources, which are among today's major environmental challenges. Sustainable development first came to the fore in mainstream discussions in the World Conservation Strategy (IUCN, 1980) and the term was propelled to prominence by the Brundtland Report, *Our common future*, of the World Commission on Environment and Development (WCED, 1987). These and subsequent international agreements have, over time, cascaded down into national policies and regulations.

The built environment has a major influence on sustainable development. Buildings consume about 32% of the world's natural resources, 12% of fresh water and 40-50% of the world's energy. Furthermore, the building industry accounts for about 55% of UK greenhouse gas emissions and 40% of landfill waste (OECD, 2003). The Intergovernmental Panel on Climate Change 4th Assessment Report (IPCC, 2007) states that the global temperature increase should be kept below 2.4°C if catastrophic effects of climate change are to be avoided. It recommends that this can be achieved if the 2050 global greenhouse emissions are reduced to at least 50% of the 1990 values. In the UK, this target has been enacted in the Climate Change Act of 2008.



Fig. 1. Projected CO₂ emissions per square metre of buildings (Allwood & Cullen, 2012)

Figure 1 shows the improvements in operation emissions expected in the UK. The operational carbon of home and non-residential buildings are expected to reduce to zero by 2016 and 2019 respectively, through making all new and refurbished buildings more energy-efficient.

In addition to operational GHG emissions, Figure 1 shows embodied carbon (EC), which is the carbon emitted in the process of manufacture, use and disposal of a product. According to the *Redefining Zero* report (RICS, 2009), the proportion of embodied to total carbon is 60% for warehouses, 45% for offices, 30% for houses and 20% for supermarkets. Furthermore, the amount of energy used by a building in service depends on its fabric and, therefore, operational emissions are intrinsically linked to embodied carbon. The structural frame itself has about 25-30% of the total embodied energy of a typical office building (SCI, 1998).

Figure 1 shows that the whole life operational emissions of a building are currently an order of magnitude higher than its embodied carbon. The graph also shows that this balance is changing rapidly as improved building designs are reducing operational emissions towards zero. With time, the focus will soon be shifting to embodied carbon as its contribution becomes prominent, which will influence the type and manufacture of materials used in the construction industry (CPA, 2012).

Doctoral Research

Not only does the need to halve the 1990 emissions by 2050 present a significant challenge, but also serious concerns because the current emission levels are already much higher than those of 1990 and the world population is estimated to increase from the current 7 billion to 9 billion by 2050. This reduction can only be achieved by looking at every sector and reducing emissions wherever possible. Steel is a carbon intensive construction material and therefore it is essential to review its environmental impact. This, together with the researcher's professional experience of designing green buildings as a structural engineer, has amalgamated into a doctoral research entitled:

“Sustainability in the built environment: consequences of steelwork building design, structure and material sourcing.”

Steel has been chosen because of its complex manufacturing process, which includes material movements across national borders. In the UK, the steel construction sector is well established with approximately 70% of multi-storey structural frames being in steel. Furthermore, about 95% of low-rise industrial buildings have steel frames (SCI, 2003).

On reviewing the existing literature, three major questions have emerged:

1. Is an appropriate environmental assessment method being employed? (**assessment**);
2. Is the environmental data for structural elements readily available and accessible? (**specification**);
3. Are there ways of reducing the environmental impact of buildings through design? (**Design**).

These three areas will be the focus of the doctoral thesis and are discussed in more detail in the following subsections.

Assessment

There are several environmental assessment methods that have been formulated to measure the sustainable use of the world's resources, as well as the control of waste and emissions in the building industry. An initial study has highlighted that these various methods essentially adopt similar approaches, although there are subtle differences between them. Consequently, and since the focus of this research is the UK market, the environmental issues considered by the Building Research Establishment Environmental Assessment Method (BREEAM, 2011) were reviewed in detail.

It is apparent that responsible material sourcing, which features in nearly every section of BREEAM, is one of the key environmental considerations. Yet it is theoretically feasible to achieve the highest "BREEAM Outstanding" rating without achieving any score under the "materials" section (BRE, 2011). Furthermore, to demonstrate compliance with this credit is almost impossible due to lack of supporting evidence. The areas of concern are that environmental data availability is inadequate and some of the information on databases is provided by manufacturers without independent verification (IStructE, 2011).

The main objective of this part of the research is to closely look at the BREEAM assessment method to see if the correct method of measurement is being employed for steelwork structures and to find ways of improving transparency. Gaps in data availability will be identified and used to inform the next stage of the research.

Specification

As a result of demand for low carbon buildings, a number of modelling tools that deal with carbon assessment have been developed for the construction industry. These range from Life Cycle Assessment (LCA), Life Cycle Inventory (LCI), Life Cycle Impact Assessment (LCIA), Environmental Product Declarations (EPD) and simple carbon footprint toolkits that are developed by individual companies.

LCA is a tool used to evaluate the potential impacts on climate change and natural resources from all stages of a product's life. This is a rigorous technique used to compare different approaches of achieving the same product or find average data from a number of producers. The environmental impact of every process within a set boundary is examined, resulting in numerical values that can be summed up and compared. An LCI is a compilation of resources and their GHG emissions. This database is the basis of LCA studies, but it can also be assessed separately to produce indicators known as LCIA (CPA, 2012).

A carbon footprint is the sum of all carbon emissions associated with a product and this single figure approach is what has been adopted by the Carbon Trust PAS 2050. The BRE uses the principle of EPD, which is another prescriptive method of expressing LCA data based on common Product Category Rules and life cycle stages. These EPD have been compiled into environmental profiles that form the basis of the

BRE Green Guide to Specification used by BREEAM and the Code for Sustainable Homes (CPA, 2012).

The objective of this second part of the research is to compile a complete inventory of environmental data for primary steel used in the UK building industry. This will include the interrogation of existing databases and collection of numerical data from the industry to either supplement or verify existing information. Available LCI databases include the BRE Green Guide to Specification (BRE, 2012), Inventory of Carbon & Energy (ICE) (Hammond & Jones, 2011) and others hidden behind commercial LCA software such as GaBi (2011) and SimaPro (2011).

Design

As a construction material, steel offers many benefits such as fast and safe assembly, less noise on site, reduced waste, and manufacturing precision as it is fabricated off-site. Steel can span long distances due to its superior strength to weight ratio, leading to a reduced amount of supports. Furthermore, the principle of steel-concrete composite action can be used to optimise the steel beam sizes (SCI, 2003).

The EC of the building depends on the amount of material it consumes. Wise (2010) suggests that Building Regulation approval should only be obtained if engineers prove that the structure is acting at more than 90% capacity, implying less than 10% waste, and those high carbon materials such as steel and concrete should only be used for structural purposes.

The two most common grades of S275 and S355 cannot be distinguished by just looking at the steel. It will be beneficial to only maintain the higher grade S355 steel. Not only does this prevent possible on-site errors of adopting S275 instead of S355 grade, but it facilitates dematerialisation (high strength enables less raw materials to be used) and encourages re-use (no verification will be necessary).

This final part of the doctoral study will review these issues in more detail with the intention of establishing typical environmental profiles for different structural arrangements that can be readily implemented at project inception stages.

Approach

The typical definition of knowledge is “justified true belief” (Knight & Turnbull, 2008). It is therefore important that the source and quality of justification of knowledge are reputable when convincing any intended epistemology community.

According to Grix (2004), ontology and epistemology act as substructure in research and hence influence the methodology, methods and sources. Thus, the epistemological paradigm needs to be set at the outset and the researcher will have to work within its constraints at all times. Not only does this assist the researcher to focus on a chosen specific subject of study but also allow a logical presentation and defence of own work. The following sections will discuss the theoretical approach, methodology and method to be employed in this research.

Theoretical approach

In philosophy, the question of knowledge derivation goes as far back as the Ancient Greek civilization and has resulted in different categories of knowledge. Depending on the context in which beliefs are developed, the level and quality of justification will differ. Generally, knowledge can be considered as objective, which is independent of the observer standpoint, or subjective and dependent on values, culture and language of the observer (Runeson & Skitmore, 2008).

Platonic, rationalism, empiricism and positivism theories all have foundationalist approaches assuming an orderly reality and objective knowledge. These are often referred to as scientific or recently as quantitative research. This approach is based on methodical experience associated with scientific experimentation with an emphasis on explaining, and not understanding, human behaviour. Thus, quantitative theories believe in observational validation of knowledge (Grix, 2004).

Pyrrhonic, interpretivism and post-modernism epistemologies conversely have Sceptics ideas that view knowledge as dependent on observer and social practices and all describe qualitative research. These discrete social theories are more difficult to improve as compared to quantitative theories that have foundational information to build upon. The discrete nature of social theories has, in part, caused obsolete theories that should have been rejected to remain in circulation (Bechtel, 1988).

From Section 3, this research is limited to numerical databases and the justifications behind building level assessment methods and therefore a quantitative approach will be employed.

Methodology

Methodology is the study of research methods, mainly focused on how specific knowledge can be acquired (Grix, 2004). This section discusses the two competing research methodologies namely deductive and inductive.

Deductive research involves the empirical testing of a theory through observation of a social reality based on foundationalist philosophical assumptions. Examples of methodologies of this type of research include experiments and analytical surveys. Although it is still dominant, deductive was until recently the only acceptable methodological approach to social science research (Dainty, 2008).

Conversely, inductive methodologies are qualitative in nature and involve the construction of theories from observations. This is borne out of the critique of the neutrality philosophies of quantitative approaches and the subjective nature of human behaviour. Inductive methodologies are underpinned by the philosophical assumption that knowledge is not natural but constructed and distributed in a medium and language that serve particular epistemological institutions (Usher & Edwards, 1994).

According to Gill & Johnston (2010), choosing a research methodology involves compromising between the underlying philosophical theories and practical considerations. A quantitative philosophical commitment has been taken and

justification for this approach given in the preceding section. In order to stay within this theoretical constraint, a deductive methodology will be engaged for this research.

Competing methodologies

Various quantitative methodologies exist in academic research and a majority of them can be adapted to work for this project. Deductive approaches discussed below include true-experiment, quasi-experiment, analytical survey and constructive research. Mixed-methods or qualitative methodologies such as action research and ethnography are irrelevant to this research and have not been discussed further.

Laboratory or true-experiment is a well-established deductive approach that involves the measurement of changes to the dependent variable caused by the researcher's manipulation of the independent variable. Experimental and control groups are designed into the procedure to neutralise the influence of extraneous variables. The assignment of subjects to the experimental and control groups can be done through random distribution or systematic controls. This control of rival hypotheses preserves the internal validity of experimental outcomes and enables replication of the experimental investigations (Gill & Johnson, 2010).

A quasi-experiment is a deductive methodology that also shares the same logic and structured procedure as the true experiment but occurs in a natural everyday setting instead of under laboratory conditions. Whilst the natural setting improves the ecological validity of subsequent findings, their internal validity is compromised as the control over extraneous variables is reduced. Random or systematic distribution of subjects to experimental and control groups is not possible and thus comparable, rather than equivalent, groups are often adopted. Furthermore, it is difficult to manipulate the independent variables in a quasi-experiment and consequently only the natural occurring variations are often observed (Gill & Johnson, 2010).

Analytical survey deductively develops or falsifies a theory using the logic of the true experiment but applying it in a natural setting. As for the quasi-experiment methodology, the ecological validity is improved at the expense of the internal validity. Unlike experimental approaches, extraneous variables in a survey are controlled during statistical analysis (Ahlgren & Walberg, 1979). A literature review is essential for the identification of these confounding factors, thereby facilitating the prior gathering of data necessary to enable control during the analysis process. Representative samples need to be assembled to ensure the population validity of the findings (Creswell, 2009).

In constructive research, researchers are either practitioners themselves or they work with practitioners to theorise practical problems. According to Jarvinen (2007), this methodology is widely used in engineering applications where the utility, rather than the intrinsic, value of a theory is of more concern. Constructive research starts with an awareness of a problem followed by conceptual development, technical development, evaluation and then the results. Conceptual development refers to the investigation of various options culminating in a model that is then fed into the next stage. The technical development stage processes the preferred scheme in detail and produces a reality, be it a new physical artefact, system or theory. In the evaluation

stage, the researcher will test the effectiveness of the outcome (α -testing) in solving the original problem. However, it is often the subsequent third party testing (β -testing) that provides the important performance measure of its effectiveness and extent of application. This methodology is often referred to as improvement research because confirming and falsifying a theory are considered equally important.

Chosen methodology

This research seeks to provide a better understanding of carbon footprint in the construction industry, obtain new data from the industry and convert general knowledge for application in a new domain. If the outcome of this research is similar to that in existence then this will confirm that current assumptions are correct, whilst a different outcome will result in improved accuracy of carbon calculations. Thus, both the success and unsuccessful outcome of the research will be useful for the construction industry. From the discussion in Section 4.2.1, it is apparent that the requirements of this research are consistent with the constructive research methodology.

True experiments usually take place in laboratory conditions where the manipulation of independent variables and neutralisation of extraneous variables is under the complete control of the researcher. As a consequence, true experiment in social sciences, where research is carried out in natural settings, is often inappropriate and rarely used. Constructive research allows the setting to move from the laboratory into the field and is, for this reason, preferred for this research.

Although quasi-experiment also occurs in a natural setting, constructive research is preferred because this research is more of data collection rather than an experiment per se. It is a correlational research which involves the observation of natural settings at a specific juncture without direct interference of the researcher.

If this research was only covering the data collection from the industry, then analytical survey would have been the preferred methodology. However, constructive research is preferred as it is the overarching methodology. Indeed, it could be argued that a hierarchy of methodologies exists, with analytical survey being subordinate. In the context of this research, analytical survey is nonetheless considered as more of a method than a methodology.

Method

An analytical survey will be adopted for this research to gather data from the industry using e-mail administered questionnaires and analysing the data using statistical methods. Data collection will be carried out over a period of twelve months to cater for seasonal variations in energy use.

The research population has been identified as all the 92 steelwork contractors that are involved in the construction of buildings in UK (NSC, 2011). Random sampling will be employed to establish and retain a smaller but representative group. The initial required sample size n has been calculated using the Cochran (1977) formula below;

$$n = [P(100-P)Z^2]/E^2 \quad \text{Equation 1}$$

A percentage variance, P of 50% has been used in this initial calculation as this produces the largest sample size. Corresponding to a 95% confidence level, a Z value of 1.96 has been adopted. A typical 5% margin of error, E , has also been considered in the above formula.

Since the sample size computed from the above formula is greater than 10% of the target population, N of 92, Cochran (1977) requires that a reduction factor be applied to the sample to obtain a new sample size, n^1 ;

$$n^1 = n/(1+n/N) \quad \text{Equation 2}$$

This gives a sample size of 74, which appears to be disproportionately large considering that there is likely to be very little operational differences between the steel fabricators. Further reviews are necessary as other particular complexities might require samples to be stratified.

Initially, the whole population will be contacted to elicit its involvement with the research and to compensate for anticipated non-responses. According to Gill & Johnson (2010), there is rarely 100% response rate to a postal or electronic survey. This initial contact will also be used to establish all the relevant background information. Research protocols will then be established with collaborating organisations before the main study is undertaken.

Due to the size and geographical spread of the sample, electronic survey is the most affordable and practical method of collecting data (Moser & Kalton, 1971). Communication with the respondents will be done through e-mails or by telephone. It is anticipated that all respondents will have the technical competence to understand the requirements of the questionnaires but briefing meetings will be conducted. A computerised survey will be designed, with information provided on a monthly basis. The questionnaire will be designed in a manner that enables the data to be analysed using statistical software such as SPSS (2011).

It is expected that once the initial commitment has been given by the collaborating contractors, non-responses will be kept to a minimum. However, commitment to providing data for 12 consecutive months is a challenge and therefore a number of procedures will be put in place to encourage participation and reduce non-responses. Some of these procedures might include raffle prizes for those who would have provided information for the whole period, involving respondents in preparing a simple but concise questionnaire, sending advance monthly reminders to all respondents and emphasising the benefit that the research will bring to the participating organisations (Simsek & Veiga, 2001). Due to the required large sample, considerable effort might be required for repeat approaches and analysis of non-respondents.

Confidentiality and anonymity should not be a concern in this survey as the information to be collected will be of general nature such as material mass and energy flows. However, ethical considerations will be taken and the introductory letter to the participating organisation will clearly establish the purpose of the research, the

integrity of the researcher, how the data will be employed or published and how confidentiality concerns will be addressed (Stanton & Rogelberg, 2001).

Programme

According to Phillips & Pugh (1987), undertaking a research project is a mammoth task with varying difficulties that range from an over-ambitious scheme, fading of initial excitement, tedious work for a long period and lack of tangible progress at times. All these difficulties are usually caused by time mismanagement and lack of planning.

The programme for this research will be broadly based on Howard & Sharp (1983) seven step sequence of identifying an area of interest, topic selection and focus, approach, research plan, data collection, data analysis and presentation of findings. The first four steps have been addressed in this paper.

In broad terms, the remaining part of the doctoral research will involve data collection in Year 3, analysis in Year 4 and the write-up in Year 5. It is acknowledged that this is an idealised representation as the process, in reality, may not be clear-cut. A detailed programme, where these high-level activities are itemised into smaller manageable tasks, will be maintained and continuously monitored.

Conclusion

Sustainable development has been prominent in the building construction industry for a few decades now. With a number of interlinked problems that need to be addressed simultaneously, and a lack of shared understanding, progress has been slow. The long term effects of GHG emissions are only predictions and there is uncertainty in the set levels of control. This is exacerbated by the lag that exists between the cause and consequence of any environmental process.

Nevertheless, there have been significant developments in the way we measure and record the environmental performance of buildings through LCA and LCI tools. Considerable energy savings and carbon footprint reductions are being made as a result of these environmental assessments. Allowing sufficient time and budget to explore carbon reduction opportunities at the outset of the design stage enables methodical and targeted solutions to be pursued without major cost implications. Part of this research will establish environmental profiles for steel structural systems to be used at these early design stages.

There is still more work to be done to improve the availability and transparency of environmental inventories. Some of the work to be undertaken in this research involves the collection of data from the UK building industry and the interrogation of the BREEAM methodology.

A quantitative approach will be adopted in this research as the project largely involves the compilation of numerical environmental databases. Consequently, a deductive constructive research methodology will be employed and data will be collected using an analytical survey. The research population has been identified as all the steelwork contractors involved in UK building construction.

A detailed programme of works has been prepared showing the major tasks and timescales. However, there is still need for the large packages to be itemised into smaller tasks that can be easily monitored.

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Employee-Driven Innovation: A Brave New World in the Build Environment's Project Organisations

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Abstract

The build environment are often characterised by the fact that product and process knowledge are closely related to, and irregular driven by, individual employees. Therefore, a methodological approach to involve employees in development is seen as an advantageous way to be more innovative. Employee-driven innovation (EDI) could be such a methodology to implicate the spoken and tacit knowledge of the employees that would strengthen the innovative capabilities of the project organisations. To investigate the theoretical field around EDI a literature study was conducted. The overall objective was to develop a theoretical framework based on the field of EDI and related methodologies. This research resulted in two main findings. First; identification of the overall themes of the EDI field of research. Second; definition of an overall framework of methodologies to conduct EDI in project organisations. Furthermore this research aims to derive a framework that is transferable to other types of organisations.

Keywords

Employee-driven innovation, Innovation management, Knowledge management, Literature review, Project organisations.

Introduction

The build environment is frequently challenged by the fragmented and project based structure, lowest-cost tender selection, prescriptive specifications and adversarial relationships. This often results in projects with cost and time overruns and consequently dissatisfied clients. This situation is also considered a main reason for the low level of innovation (Manley and McFallan, 2006).

Innovation is no longer only a task for specialists and R&D departments. According to de Sousa et al. (2012) more than 80 percentages of every innovation produced today are generated from smaller incremental innovations. Hence the main potential lies in the smaller innovative steps that often are driven by the creativity of the workforce, when existing products, processes or services are optimised or reinvented (Dorenbosch et al., 2005). Involvement of employees has been a research topic for some years, but it has never been formalised in terms of a theoretical or practical framework (Bakker and Demerouti, 2008). Innovation depends on a system that can process the initial idea from individual creativity through a group level which will

handle the variety of obstacles in adoption to dissemination and implementation of the idea (de Sousa et al., 2012).

In project lead organisations within the build environment the product and process knowledge are closely related to individual employees. This knowledge is often very difficult to identify, hence difficult to collect, share and utilise across the organisation. To succeed, a systematic framework or methodology such as EDI, which features tools for managing structure, culture and methods in project organisations, would be beneficial. EDI is not a well documented field of research in general innovation literature and is, therefore, often seen in a greater innovation context, in which it often is de-emphasised contrary to product and process innovation (Høyrup, 2010).

The main objective of this research is to answer the following research question (RQ):

Which areas of the field of EDI and related methodologies should be integrated in a framework that can be adapted to fit project organisations in the build environment?

The RQ was answered through a literature study. From the study a base of evidence was generated. This base called the A-list of articles was further reviewed and analysed to identify the overall themes of EDI and the related tools and methods. The development of the specific framework of tools and methods are out of the scope of this article.

Method

The literature study is structured in three phases. Firstly, the most significant keywords related to conducting EDI were identified. The keywords were selected based on prior experience obtained through research within the fields of construction management and innovation, and through discussions with research colleagues. The keywords identified were; employee, innovation, management, construction management, project organisation, management control systems.

Secondly, a systematic approach to identify and form a base of evidence was conducted. This phase was guided by the steps followed in Pittaway et al. (2004) and Levy and Ellis (2006). Through a citation database review, the following citation databases were chosen; *Web of Science*, *Business Source Premier*, *JSTOR* and *ABI ProQuest*. Search strings formed by combinations of keywords were applied to the aforementioned citation databases. This resulted in a list of 300 journal articles. The articles were divided according to their relevance:

- The A-list represents articles of high relevance and the full articles are included in the review and analysed (109 articles)
- The B-list represents articles of some relevance, but with more doubtful empirical data. (82 articles)
- The C-list represents articles with little relevance or articles that have a more conceptual approach or background of the topic. (109 articles)

The final selection of the A-list articles was conducted based on the following quality criteria; *theories robustness/state-of-the-art*, *the use of data*, *implementation potential*, and *potential transferability/ generalibility*. This step entailed that the articles in the A-list were separated in an A+ and an A list. The main reason was the large amount,

but also the process of ranking the articles gave this natural selection on the A list articles. The A+ list contained 46 articles and the A list 63.

Third phase was coding themes in the A+ list articles using the analytical program NVivo. NVivo was utilised to generate a general impression of the themes that emanated from the articles in the A+ list. The themes that emanated from the coding are illustrated in table 1.

Table 1: Result from coding the A+ list articles.

<i>Theme</i>	<i>Articles</i>	<i>Percentage</i>
<i>Innovative organisation</i>	<i>17</i>	<i>37</i>
<i>Innovation management</i>	<i>9</i>	<i>20</i>
<i>Knowledge management</i>	<i>8</i>	<i>17</i>
<i>Employee motivation</i>	<i>7</i>	<i>15</i>
<i>Human resource management (HRM)</i>	<i>5</i>	<i>11</i>
<i>Total</i>	<i>46</i>	<i>100</i>

Methodological implications

One methodological challenge was that the term innovation is quite ambiguous. Hence a clear definition must be applied. This research used the following definition on innovation:

“Innovation is the process of making changes, large and small, radical and incremental, to products, processes, and services that results in the introduction of something new for the organisation that adds value to customers and contribute to the knowledge store of the organisations.”: O'Sullivan and Dooley (2009, p. 5)

The keywords forming the basic search string, *employee* and *innovation* are often considered buzzword, which resulted in a large number of citations. Therefore, the selection criteria had to be very rigid to narrow down the number of citations to integrate in the A-list.

Another challenge was the limitation in the systematic approach, where some of the preferences in the search process are related to a preferred publishing discipline; books, journal articles, e.g. Thus through the attempt to narrow down the search, the contribution from some of research field e.g. sociology or architecture could be overlooked.

Findings

The articles were reviewed according to themes (cf. Table) occurring from the NVivo analysis focusing on indentifying methodologies to form a framework for conduction EDI in relation to the RQ. Innovative organisations

From the acknowledgement that individuals cannot drive an organisation towards innovation by themselves, this research emphasise an organisational culture formed by the sum of employees. Dobni (2008) define innovative organisations as:

- They are competitive innovators in that they continue to break through to the next level because they are constantly defining it.

- They understand that the foundation of innovation is based on the sum of the employees; the way they act, do and think allow the organisation to be innovative.
- They are rooted in a culture that is proactive and market driven, and the employees all feel and know, why they are on the top of the game.
- They made decisions and changes in the past to become more innovative, that at the time required sacrifices but ones they benefit from today.
- Innovative organisations are better in utilizing the internal resource to define, engage and pursue emergent opportunities.

Organisations, who decide to focus on innovation as a part of the culture and competitive advantage, have to be aware that it is a comprehensive process of change. Implementing innovative approaches just for the sake of innovation and branding can be damaging for organisations (de Sousa et al., 2012). By highlighting the importance of innovation and defining the innovative behaviour in an innovation strategy, an organisational culture can foster innovation (Hartmann, 2006).

When competing in a knowledge-based society innovative organisations are enhancing their competitiveness, contrary to those who are persistently holding on to old industry traditions. In organisations that emphasise innovation, shared leadership is needed because of the complex nature of this process, especially at group and organisational level (Carmeli et al., 2006). Ideation and brainstorm activities are often considered the easy part, since ideas and creativity often emanates from individuals. The challenging part of innovation is to develop and implement a system to turn creativity into a profitable business (de Sousa et al., 2012).

It would be obvious for organisations, who strive to be more innovative, to just employ more creative and talented employees. This could possible lead to a short-term increase in creativity. But to be sustainable creative talents need colleagues or partners with business knowledge to comment, sell, adopt and implement the ideas. Hence one of the most important assets for organisations, who are changing to be more innovative, are innovation or creative management that recognise and promote existing talents and their ideas (de Sousa et al., 2012). Commercialising ideas into corporate profit requires persistence and discipline, and the overall effectiveness depends on the top managements abilities to balance between corporate creativity and efficiency (Leavy, 2005).

A pitfall for innovative organisations is that they tend to focus too much on specific innovation practices and policies, and not enough on the organisation philosophies and values that are the foundation of the innovative culture. According to Leavy (2005), there are four organisational or climate-setting factors that are fundamental to innovative success:

- Placing people and ideas at the heart of the management philosophy
- Giving people room to grow, to try thing and learn from their mistakes.
- Building a strong sense of openness, trust and community across the organisation.
- Facilitating the internal mobility of talent

These four elements will support the generation of an organisational climate, where creativity and initiative can flourish, and talent and ideas circulate freely.

For an organisation to innovative it requires a balance between play and discipline, practice and process, creativity and efficiency. Hence the upper management must define the right balance on at least three levels; in the innovative process, between the primary functions in the organisation, and in their overall approach to corporate management (Leavy, 2005).

Innovation Management

Earlier studies on innovative behaviour have focused on incremental, process-related innovation at the shop-floor level of organisations. Innovative work behaviour has, therefore, merely been considered as extra-role behaviour that is not usually recognised by the formal reward systems of an organisation (Tuominen and Toivonen, 2011).

In research literature it is well documented that ideas are considered the raw material for innovation, hence the importance of generating an adequate number of ideas are significant (Adams et al., 2006). Innovation management abilities are related to project management. Managing innovation requires persons who commit themselves to a project or an idea, they have to be enthusiastic and motivated to support and promote. According to Mansfeld et al. (2010) innovation managers must possess the skills of the two roles *champion* and *promoter*. The champion support innovation through enthusiasm, confidence, persistence, and the managerial skills to assemble the right team. The promoter either; possess the technical knowledge to advance or further develop the ideas, possess the necessary hierarchical power to drive the project or apply the needed resources, or has the organisational network and influence to support the idea. Mansfeld et al. (2010) define these skills and different roles in the general management role as an innovator, the person or character that can push the innovation to succeed.

When managing innovative employees, Kleysen and Street (2001) have identified five dimensions of innovative behaviour that innovation management should support and encourage; opportunity exploration, generativity, formative investigations, championing, application. They all play an important part in making innovation a part of business as usual, representing the activities as implementing, modifying and routinising. A challenge in relation to encourage the employees to be creative is that the management must carefully distinguish between expected, encouraged and non-expected behaviours according to role and employment. But if the management is aware of the variety of innovative behaviour, the innovative processes would be more effective (Tuominen and Toivonen, 2011).

In high-risk design projects stage-gate models are often used as a management tool to control the development of the projects (Onarheim and Christensen, 2012). Adams et al. (2006) have elaborated a framework containing seven categories with different areas of innovation measurement. The areas are:

- *Input* measured by people, physical and financial resources, and tools.
- *Knowledge management* measured by ideation, knowledge repository, and information flows.
- *Innovation strategy* measured by strategic orientation, and strategic leadership.
- *Organisation and culture* measured by culture, and structure;
- *Portfolio management* measured by risk/return balance, and use of optimisation tools

- *Project management* measured by project efficiency, tools, communications, and collaboration
- *Commercialisation* measured by market research, market testing, and marketing and sales.

These categories and areas of measurement could be considered a balanced scorecard for innovation management, with a balanced set of KPI's that can provide an indication of an organisation's readiness or ability to manage innovation (Adams et al., 2006).

Radical innovation projects and incremental innovation should be managed in different ways (Subramaniam and Youndt, 2005). Radical innovation requires more creative, out-of-the-box thinking, and more skilled employees to directly improve innovation performance. When implementing incremental innovation approaches human capital plays a less central role, but cannot be neglected due to the importance of information and knowledge sharing (Lee et al., 2011). The human capital are materialised in the employees knowledge. One of the most essential perspectives of EDI is the principle of involving internal and already paid resources with an existing knowledge on organisational domains (Onarheim and Christensen, 2012). To generate and maintain employee commitment and motivation requires suitable managerial actions. Some of the essential mechanisms to trigger such commitment and motivation are; communication, recognition and rewards, participation, and symbolism (Kesting and Ulhøi, 2010; Hartmann, 2006).

Idea evaluation and selection are crucial in innovation projects. One method related to EDI is voting schemes involving both decision-makers and employee participants (Onarheim and Christensen, 2012; Cousin, 1998). But one of the challenges in ideation and creative processes is that the creators of or contributors to an idea tend to hold their own contributions higher than other ideas. Hence the relation between the idea owner(s) and the decision-makers on which ideas should progress must be carefully considered (Onarheim and Christensen, 2012). On the other hand, employees could keep their ideas to themselves, if they anticipate that someone else will get the credit. When the employees contribute to the ideation and their idea is selected, it is essential that the management support the employees in championing their ideas and creating a no-blame culture (Tuominen and Toivonen, 2011; Manley and McFallan, 2006). de Sousa et al. (2012) emphasise that instead of measuring the profit related parameters, intangible measures as; employee or customers satisfaction, training in innovation tools, skills acquired, or the existence and use of a formal system of idea management, can be much more important as success parameters.

Knowledge management

Knowledge-sharing amongst the employees in an organisation is essential if the organisation strive for an innovative culture. Knowledge management (KM) is driven by people not technology, therefore elements such as social activities, culture, sharing and learning are keys to apply KM (*O'Dell and Hubert, 2011*).

KM is considered an integrated part of innovation in a model that could be defined in the three phenomena (Mireille and Wim, 2005):

- individual and social learning at the workplace (transforming existing information into knowledge),

- knowledge creation (creation of new knowledge), and
- innovation (transforming knowledge to added value)

Intellectual capital is one of the most essential types of knowledge resources used by learning organisations. Intellectual capital is more recently defined broadly in three central themes; human capital (employees knowledge), structural capital (organisational systems), and social capital (cultural and social structures) (Lee et al., 2011). KM involves the creation, sharing, validation, utilization, and management of tacit and explicit knowledge (Bonnie and Monica, 2007; Thite, 2004). One obstacle for knowledge-sharing is unwillingness to share knowledge that could be triggered, if the employees realises that knowledge is power, whereas some might withhold their knowledge to pursue personal interests (Bonnie and Monica, 2007).

One of the most important processes of knowledge-creating organisations is coding implicit and tacit knowledge into explicit knowledge, and transforming it into ideas that potentially could develop and optimise the organisation (Mireille and Wim, 2005). Through a case study Mireille and Wim (2005) found that three important aspects of a knowledge-creating organisation are:

- the role of the supervisors and managers
- knowledge sharing and reflective learning
- rotation of valuable employees

The challenge for the KM is managing the processes that ensures that the right knowledge, reach the right people, at the right time (*O'Dell and Hubert, 2011*). One pitfall when applying KM is to force a cultural change of the organisation in preparing for a KM program. If the employees are encouraged to focus actively on knowledge sharing and interdisciplinary collaboration, the organisational culture will often change as consequence of the employees' new behaviour (*O'Dell and Hubert, 2011*). Three enablers in applying a KM program are; lead by an example, brand KM through communication, branding, recognition and rewards, and make KM amusing (*O'Dell and Hubert, 2011*).

Employee motivation

Understanding what makes knowledge employees motivated to innovate in organisations, has been a managerial issue for some time (Amar, 2004) As mentioned, innovation is no longer just a phenomenon for specialist and R&D employees. The employees possess the hands-on experience with the daily working processes. Hence they possess the knowledge to contribute to upgrading of working processes, optimising communication channels, the use of computers, and development of new product or services. Employees should be encouraged to innovate on a daily basis, as innovation must address the operational issues that arise all over the organisation, and are important to stay ahead of competitors (Cousin, 1998). Job satisfaction and motivation for the participants in development projects can be created through EDI, as they feel involved. Onarheim and Christensen (2012) did a survey after completing a EDI development project, where the participating employees emphasised the process as motivating, inspiring and exciting for the participant, with several request for using involvement of employees broadly in projects. Allowing for autonomous work stimulates employees to develop, refine, and test new ideas, as it entail a higher degree of responsibility in projects (Hartmann, 2006). An award scheme is an

efficient way of identifying, acknowledging and circulation information about innovations (Cousin, 1998). Amar (2004) emphasise five groups of drivers that motivates the behaviour of knowledge workers; sociological, psychological, generational, knowledge-work and cultural.

Motivation of knowledge employees can also be accomplished by the presence of the right antecedents. Based on the assumption that employees find assignments exciting, they get motivated, according to Amar (2004) three motivation sources could be:

- job (job character)
- outcome (rewards, punishment)
- organisational system (policies, practices, culture)

Hence, if managers want to keep the employees motivated and excited, they can imply antecedents into these sources. Some of the antecedents are related to (de Sousa et al., 2012; Adams et al., 2006):

- employee autonomy
- available information and communication
- reward system
- education or training
- system of authority
- participation in decision-making
- team cohesion

Human resource management

The contribution and input to innovation are moving towards a broader range of employees. Dorenbosch et al. (2005) defines the phenomenon “On-the-job Innovation” or innovation work behaviour (IWB), where they emphasise the potential advantage in involving the general workforce. Innovative work behaviour is considered complex and are somewhat dependent on commitment-oriented HRM practices. IWB can be separated in four interrelated behavioural activities:

- problem recognition
- idea generation
- idea promotion
- idea realisation

The first two activities are related to creativity-oriented work behaviour and the final two are related to implementation-oriented work behaviour (Dorenbosch et al., 2005). The key elements of commitment-oriented HRM are to stimulate the desired employee behaviour and attitudes, by establishing psychological relations between organisational and employee objectives (Dorenbosch et al., 2005). Boselie et al. (2001) have developed a scale to measure to what extent a HRM system is high or low commitment-oriented. The scale measures the five aspects:

- employee participation
- wages
- training and development
- information sharing
- supervisor support

Through a larger survey Dorenbosch et al. (2005) investigated the perception on how job design and HRM can effect creativity and IWB. They found some indication on that employees who consider HRM as being commitment-oriented feel more ownership for work issues beyond their direct assignments, thus contributing in a higher degree to IWB. In relation to job design, the survey showed that more flexible job designs offer better conditions for IWB, as the flexible frames broaden the scope of work beyond the assignment directions. Flexible job designs creates more room for development and ideation, hence more creative freedom in the problem-solving and commitment to the employees' own ideas.

Employee's human capital and HR practices have a positive effect on innovation (De Winne and Sels, 2010). A combined strategy of valuing and managing human resources can significantly strengthen innovation performance. In their research De Winne and Sels (2010) further emphasise that good management of resources in general is important and should not be neglected. The strategy should simultaneously strive to attract and invest in highly skilled employees and implementation of an intensive HRM. (Manley and McFallan, 2006). From an economic point of view, investment in intensive and sophisticated HRM practices is only justified, if it is cost-effective in the long-term (De Winne and Sels, 2010).

Discussion and Conclusion

Through the systematic review on EDI, a sufficient base of evidence was identified to give an overview of the research topic. Through the themes indentified, the objective was to form a base of evidence for developing an overall theoretical framework, with each theme holding a number of tools and methods to conduct and implement an EDI process. When organisations begin implementing innovative processes it is important to initiate the following activities:

- Definition of an innovation strategy and the innovative behaviour that places people and ideas at the heart of the management philosophy, giving people room to grow to try things and learn from their mistakes and building openness and trust across the organisation.
- Finding antecedents to commit and motivate employees
- Defining the balance between play and discipline, creativity and efficiency
- Customisation and implementation of a system or structure to process ideas to sustainable solutions and profit
- Implementation of commitment-oriented HRM to create more ownership for work issues amongst the employees

The most important methodologies found in this research that should be adapted in a framework were, Innovation management, KM and HRM. Managing the innovation requires focus on motivation, communication, commitment, recognition and participation. Innovation management also concerns ensuring the involved employees contribute and not keep the ideas to themselves through rewards and recognitions to the owner of the idea. Followed by an evaluation and selection of ideas, where the suggested tool is voting schemes. It is important for the managers to reflect on the possibility that the various types of innovative behaviour can be integrated in several stages of an innovation process.

Ideation is based on the knowledge of the employees. The most essential type of knowledge resource is intellectual capital that broadly consists of human capital, structural capital and social capital. Managing knowledge is centred on coding implicit and tacit knowledge amongst the employees and facilitation of the processes that allow this knowledge to transform into ideas. Hence KM are to a great extent dependent on the managers ability to create explicit knowledge from the employees' implicit knowledge. One of the most important skills of managing innovative group dynamics is to know when to leave organisation hierarchy out of the process, and when to bring it back again (Leavy, 2005). The leading challenge for innovative organisation is maintaining the balance between innovation and efficiency, as they grow and develop.

The findings in this research are considered as generic as they can be adapted to other types of organisations than project organisations. Future research should develop a specific framework of tools and methods that could be fitted into an innovation process model to control innovative projects and processes in the build environment's project organisations. Further, areas of measurements can be an indicator on an organisation's current and continuous development abilities to conduct and manage EDI.

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Social media in construction: combines content and network analysis to understand interactions in LinkedIn Groups discussions

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Abstract

This research explores the potential of social media mobilized informally for professional interactions in construction. It aims to study social media enabled digital interaction networks by examining the network effectiveness with three characters that are extracted from literatures of network theory. This research observes information exchanges, which are the only consistent object through the discussion process. This research uses combined methods to analyse the unstructured chats that are downloaded from LinkedIn website. Content analysis captures the linear chain mannered information flow and interacts with participants, while social network analysis visualises and measures the organic structure of interaction network among participants. Contrasted findings suggest the combined analysis methods provide more comprehensive understanding of interactions in content, process and relationships. Findings on interaction network corroborate those three characters and extra findings reflect on individuals functional roles are identified to reveal structure of further interaction networks in future studies.

Keywords

LinkedIn, interactions, social media, social network analysis, content analysis.

1. Theoretical backgrounds

1.1 Introduction

Social media such as Wiki, LinkedIn, and Twitter is increasingly pervasive in our daily lives. Scholars are interested in understanding the implementation of social media in different contexts. For instance, Wiki's importance of facilitating collaborative work and supporting for knowledge sharing, storing and communication process within organizations has been emphasized in university administration (Raman, 2006) and teaching (Parker and Chao, 2007). Workplace use of social networking sites such as LinkedIn and Facebook have been learned and compared in some Information Technology (IT) enterprises (Skeels and Grudin, 2009), it identifies LinkedIn as a perfect storm for young professionals to establish their professional network, source career opportunities and strengthen skills and knowledge of their expertise, and also articulate that the management related activities are not intensively engaged with social media but the use of creating and strengthening ties, mixing work and professional connections are fundamental in workplace. All these researches pointed out those implementations of social media are tightly coupled with interactions in digital environment.

Therefore, how social media enabled interactions benefit construction sectors is the main focus of this research. In construction field, developing a social media strategy is of interest in industrial practice (Wilkinson, 2009), focusing on the use of communication and collaboration on marketing and public relations (Brown, 2012). But this research is more interested in observing interactions in social media from a relationship perspective.

1.2 Social network theory and three characters

Some researches on ‘interactions’ are associated with Human-Computer Interactions, but here interactions are defined as information exchanges between participants in particular digital enabled environment. Newman (2010) states networks can be used to represent patterns of connections or interactions of a given system, and interactions visualised as lines are referred to as edges. This research is based on the network theory to develop three characters that are directly affected on the network performance.

Social network theory provides the theoretical perspectives, practical models and methodological approaches for organizational communication studies (Rice, 1992). This research uses this network perspective to reveal the information exchange through an informal conversation among multiple participants. Different structures of networks are different in advantages of information related activities. Granovetter (1973) argues that a weak tie network is likely to obtain new information from disparate parts of the system. While Hansen (1999) argues, in contrast, strong tie networks are better in knowledge transferring. The structural-hole theory (Burt, 1992) that are developed from weak tie theory, is emphasized on the advantages derived from controlling information flow between interpersonal relations (Burt, 2008, Burt, 2007).

Drawing from these three arguments of network literature, there are three corresponding characters are concluded to approach to effective network in exchanging information:

1. effective in building connections with external environment (weak-tie network structure in boundary);
2. effective in strengthening ties in internal social network (strong-tie network structure at core); and
3. stable brokerage position (the stability of brokerage is effect on the consistent and stable distance between new participants and the core participant).

Social media enables informal discussion networks, and also is radical in building connections through networking. From these literatures of networks, network performance can be examined and determined by analysing and measuring these three characters.

1.3 Aim and objectives

The aim of this project is to study social media enabled digital interaction networks by examining the network effectiveness with those three characters. The most popular social media tool contributing to professions and experts is LinkedIn, and it generalised a function of Groups to exchange information in different professional interests.

Two objectives are proposed to achieve the aim.

1. To examine LinkedIn Groups (social media) enabled interaction network of informal communications, by observing the information exchanging flow, which is the only consistent object through the discussion process.
2. To determine the effectiveness of LinkedIn discussion networks by using those three characters of network.

1.4 Methods

This research combines method of content analysis and social network analysis (Loosemore, 1998), to examine the network of interactions. Content analysis is defined as *a research technique for making replicable and valid inferences from text (or other meaningful matter) to the contexts of their use* (Krippendorff, 2004: 18). Krippendorff (2004) content analysis approaches of conversation analysis and contingency analysis, are able to analyse the network relationships of certain texts, it is more distinct to present the movements in a linear chain manner. But they are still grounded in texts rather than relation or network concludes. Every research technique has its powers and its limitations. Therefore, social network analysis method is combined to capture the organic structure of information exchange networks (El-Sheikh and Pryke, 2010).

A social network is basically comprised a set of nodes connected by one or more links, which represents distinct types of relationships, and social network analysis views social relationships in terms of network theory, consisting of nodes and link (Pinheiro, 2010). There are some well-developed methods and techniques in social network analysis to examine networks. Nahapiet and Ghoshal's (1998, Freeman, 1979) emphasis the ability to build social capital (social connection) can be used to measure the effectiveness of network structure. Those major measures are determined as the Centrality by Freeman (1979) and developed with Brokerage by (Borgatti et al., 2002, Burt, 2007, Burt, 2008). These measurements will be used to visualise the network structure, to determine the network performance, and further to identify individual or group roles of participants.

2. Research settings

LinkedIn is mainly used for professional networking. 65million new members registered with LinkedIn last year with a total member of 200 million since January 2013. The selected discussion group is the most active group in Building Information Modelling (BIM). It is created on 5th May 2008 has 15 thousands members is selected. It is the largest and the most active Group discussing BIM issues. The author registered with LinkedIn to create a personal ID, and then joined several discussion Groups that are highly active and recommended in Architecture, BIM, and Social Media areas.

2.1 Data collection

In LinkedIn Group, a discussion means a topic created by any member of this Group, and it can be followed by other members. 651 discussions have been tracked in 6 months period from 1st January to 3rd July in 2012, selected automatically by the embedded function of Most Popular Discussions. The number of comments is a parameter used to measure the interaction of discussions. Author classifies these discussions with 5 degrees by number of comments. The discussion belongs to Degree 1 (the lowest degree), as the number of comments is up to 4; and the discussion belongs to degree 5 (the highest degree), if the number of comments is

more than 51. All degrees are presented in Table 1. There are 14 discussions have more than 51 comments of each in the selected time period. Then use the other filtering function of Latest Discussions to select the latest updated one discussion out of fourteen in the cluster of Degree 5.

Table 1: The 5-degree table of discussions, which is classified by the amount of comments.

Degrees	1	2	3	4	5
Number of comments	0 - 4	5 - 9	10 - 20	21 - 50	51 -
Number of discussions	492	79	38	28	14

The selected discussion is initiated on 19th June 2012 and the analysing period is up to 5th July. During this 17 days period, there are 27 participants from 6 countries get involved. As long as get into the detail of each comments and participants, it is difficult to understand the whole load of information within this single discussion. Data is downloaded directly from LinkedIn to analyse.

2.2 Data analysis

A diagram (see Fig. 1) is developed to track all comments in both time order (horizontal) and participants order (vertical) to present the relationship between comments, and also to present the involvements of participants with certain comments in certain time. In this diagram, points are representing comments; and lines are representing the relation between two points. Then converge the content analysis of all comments with the diagram to make sense of several turn points and the role of particular participants, such as who input the most comments, who regularly involved in this discussion through the whole period, and whose comments has the most responses.

The discussion network was converted to a matrix format from the process-tracing diagram. Nodes represent participants and connected by the interaction relationships. If two participants connected by solid line (both orange and green in Fig. 1), the relationship between these two participants is considered as 1 (no matter there is only one connection or more), otherwise if there is no connections or only dash line connection, the relationship is considered as 0. This matrix format of interactions is visualized by a widely used social network analysis program UCINET 6 (Borgatti et al., 2002).

3. Findings

Findings demonstrate only one selected discussion in LinkedIn as a pilot study; more samples of discussions will be examined in the future for a broader consideration and implementation.

3.1 Analysis of the process and contents

Fig. 1 is presenting this discussion's movements. There are three types of lines have been used to show different relations.

1. Solid orange line shows that the later point (comment) is responding to the previous one (comment), the response here could be understand as answer a

- question, add further information or make a judgment to the previous statement.
2. Dashed orange line means the later point (comment) has no interaction the previous one (comment) but posted direct after it.
 3. Solid green line means the later point (comment) is responding to the previous one (comment) cross time.

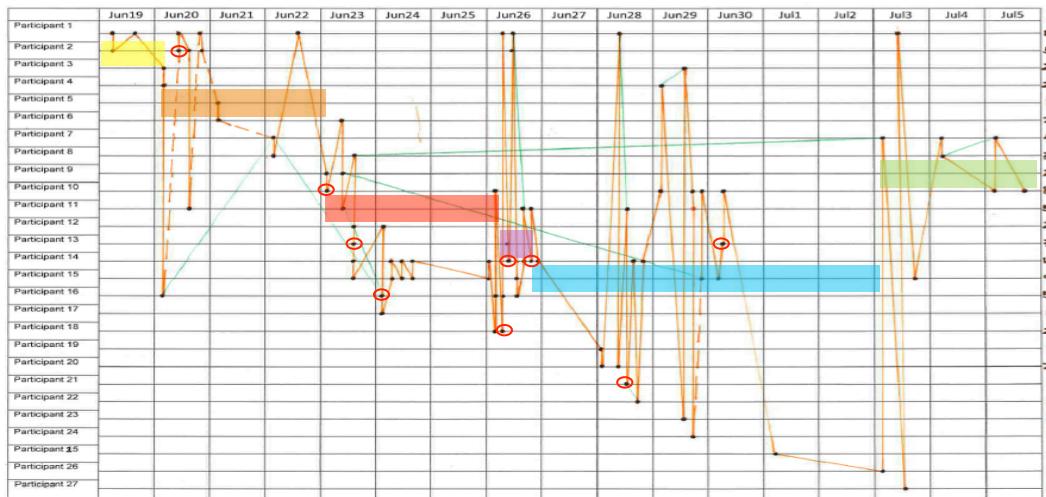


Fig. 1: Integrated findings with content in the interaction tracing diagram.

Departure from this diagram, we can see on 20th June, interactive comments from participant 2 to participant 1 then move to participant 11 have been isolated by two orange dash lines, as the same as the interactive comments between participant 5 and 6 on the same day. This type of short interaction is codes as Interrupt Conversation.

There are only two Interrupt Conversations through the whole period but concentrated in the 2nd and 3rd days.

The first solid green line connects participant 16 from 20th June and participant 7 on 22nd June. It seems that participant 7 took over the main stream of this discussion despite all these interruptive comments on 20th and 21st June.

From the right end calculation of each participant's involvements (see Fig. 1), participant 1, 10, 14 and 15 are distinguished in this half-month discussion. But we can see all involvements of participant 1, 10 and 15 are kind of evenly distributed in the whole time period, but involvements of participant 14 are centralized in two days (24th and 26th June).

3 gap days showed in this diagram (which are Monday, Wednesday and Monday timely ordered), and after each gap day, the involvements of participants have been promoted in some degree. They show the trend of this discussion that when it begins to fall off and when it is accelerated. To integrate these findings with the content of all comments, we find more to explain the turning point of the discussion process. In Fig. 1, the coloured bars are representing the focus of this discussion is shifting all the way long. The points have been red circled means fresh ideas and concepts have been brought in the discussion by particular participants. All these circled engagements have been analysed and presented in Table 2.

Table 2: Findings and empirical evidences contrast table in different coloured periods.

Periods	Key movements	Content of key movements
Yellow (Day1)	This period focus on the initial topic of Revit 2013 release is stagnating in big changes of the technology.	<i>"... the latest release lacks an "overarching theme or grand vision", and proposes that the software has reached a point at which users are no longer interested in major changes...I don't think it's accurate to say users are not interested in any more major changes... This release doesn't seem symptomatic of stagnation to me."</i>
Orange (Day2- 4)	Focus shifts to compare other modelling tools adding direct experience and awareness of software by participant 2. The conversation compares the global market share of software providers, and their local differences.	<i>"...it sounds like ArchiCAD did a better job of marketing their improvements ... Want seriously whacked out shapes and fantastical nurbs- Check out Ghery's software... working in Bentley BIM sighed out, because Bentley kept crashing..."</i> <i>"Here are the 2011 figures: Autodesk AEC Net Revenue \$626 million, Bentley \$523 Million, Graphisoft \$11 million EURO Nett Revenue and lastly Nemetschek earned Nett 20.8 Million Euro. So I estimate Autodesk has 53% and Bentley has 43%."</i>
Red (Day5-7)	Participant 10 leads a consideration of the potential development of Revit. Then participant 12 posted a strong conclusion on Revit themes for developing. Participant 16 concludes 9 reasons to explain why Revit 2013 is lack of new features, and hastens later discussion.	<i>"For me, new online collaboration and document management tools are a higher priority. Autodesk developing a "Cloud based service" makes a lot of sense..."</i> <i>"But I think you can simple say the following big themes have been arching over the last few releases of revit: 1. Analysis!!!!!! 2. Mass modelling. 3. Collaborative working. "</i> <i>"Why the lack of new features in the 2013 release? I think more likely reasons may be: 1. New features get harder and harder to implement as the application matures; 2. Revit was apparently not written to be very open by its original authors; ... 9. Interoperability with DWG data..."</i>
Purple (Day8)	This day shifts its focus on several detailed features of Revit new release. Participant 18 provides thought of mobility use of 3rd Party. Participant 14 inputs 2 comments to specify 3 directions of developing cloud-based computing and BIM use for other disciplines.	<i>"...the better the program will get because the more companies and minds you have working on a problem. APIs, SDK etc. common practice from the iphone through revit."</i> <i>"Cloud-based to support mobility apps? Sure... Cloud-based to support parallel computing? Yea. Cloud-based to key into the new social media phenomenon? Yes."</i> <i>"This kind of 'horizontal BIM' integration is pretty important. Just as all the MCAD apps integrate FEA analysis, GDT tolerancing, CNC-machinability checking and other analysis functionality into the base design app, the cross disciplinary feedback should be as close to the designer as possible."</i>
Blue (Day9-14)	Participant 14's second comment ends with detailed features then turned focus on BIM concept of sharing and collaborating. Participants 21 add a new idea of using spreadsheet links. Participant 13 emphasis the term of collaboration.	<i>"This kind of 'horizontal BIM' integration is pretty important. The other area where 'analysis' is getting is clash detection...Most of the BIM 'collaboration' stuff you hear about suffer from the same problems with its 'more QA' approach to achieving 'more quality'... and Bentley has had Project Wise, and tons of project hosting apps..."</i> <i>"Perhaps the key change will prove to be the improved IFC and spread-sheet links. So now designs managers have to make a data strategy!"</i> <i>"I would agree that the collaboration aspect is lacking and ripe for development with the most obvious solution being more of a cloud based solution."</i>
Green (Day15-17)	The conversation focuses on detailed software again around BIM-6. Participant 1 adds several website links regarding to the BIM and software to increase activeness.	<i>"BIM-6 revenues might be analyzed by placing their products and services into (2) distinct categories: Content Creation (OSI-7) & Content Management (OSI-3)..."</i> <i>"...another AEC/BIM acquisition (WinEstimator) to add to Tekla, Meridien, QuickPen, SketchUp, Plancal etc... http://www.constructech... ...the figures were from the published annual reports. For example...(websites) "</i>

Findings from Fig. 1 and Table 2 are following the extreme linear chain manner to reveal the discussion process. Contributions of each participant can be easily located in a particular period or the entire process. This is a typical virtual Communities of Practice (Ardichvili et al., 2003) in a broader industry domain. But from the analysis of process and content, it is difficult to capture and reveal the relationship structure of the discussion community, which is important to understand how certain type of interaction network established to exchange information.

Analysis of the network and relationship

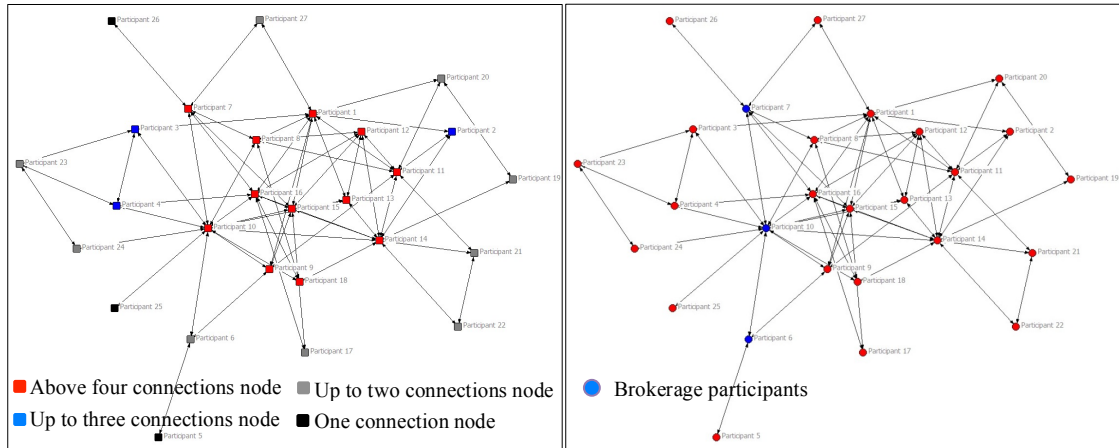


Fig. 2: K-core analysis map (left) and brokerage analysis map (right) of the target discussion created by UCINET 6 (Borgatti et al., 2002).

Network analysis provided by UCINET 6 (Borgatti et al., 2002) shows the interaction pattern (see Fig. 2 left). In this figure, participants have been classified by the Degree Centrality (e.g. The Red nodes are representing the core group of participants who has the highest Degree Centrality). Distributions are based on this measurement, which means the people who have more connections are more closed to the centre of the network, and vice versa.

Contrast participants' contributions (the number of involvements) to Degree Centrality (the number of connections), we find the participant who has the most connections is not the one posting the most comments. In particular, we can see from Table 3, participant 10 has the highest Degree Centrality of 13 with only 8 posts through the discussion, and participant 14 who posts 11 comments and establishes connections with 11 people.

Another interest finding from this table is different type of interactions can be identified by monitoring the differences between contributions and Degree Centrality. For instance, participant 16 by posting 5 comments to build connections with 9 different people, in opposite position, participant 15 by posting 9 comments to build connection with 8 people (almost one third of his involvements are happened with participant 14). These differences indicate that participant 16 engaged in more collaborative work, and participant 15 works in a more personal contributing position.

Fig. 3 shows participant 10 has the strongest ability to intermediate any other two participants with the shortest path. Integrating findings from Fig. 2 (right) with Fig. 3, we find participant 10 is distinct in controlling the information flow. Fig. 2 (right) shows participant 10 is the only one who has the direct connections with participants

in all degrees that show in Fig. 2 (left), which means participant 10 holds the access of participant 25 to the discussion network, and also shortened the distance of participant 3, 4, 5, 23, 24, 25, and 26 to the core information.

Table 3: Distinguished 6 participants in connection calculation (left) contrast to their total involvements (right).

Rank	Participant	Number of connection (Degree centrality)	Rank	Participant	Number of involvement
1	Participant 10	13	1	Participant 14	11
2	Participant 14	11	2	Participant 15	9
3	Participant 1	10	3	Participant 10	8
4	Participant 15	9	4	Participant 1	8
5	Participant 16	9	5	Participant 11	5
6	Participant 11	8	6	Participant 16	5

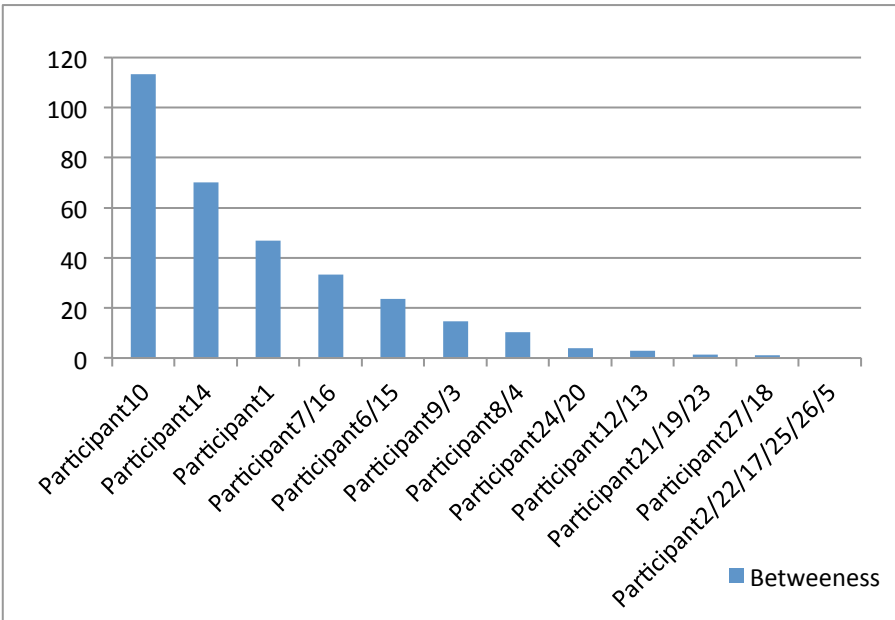


Fig. 3 Betweenness Centrality measures of the target discussion network created by UCINET 6 (Borgatti et al., 2002).

In the identification of distinct participants, the results from network analysis reflects in the process analysis shows that participant 10 is specified only in the beginning of the red period of the discussion process, when it is first time involved in the discussion, and so as to participant 16. Participant 13, 18 and 21, however, has less contributions and connections in the network; they are emphasized in the process analysis in pushing the discussion move forward. These findings reflect on the weak tie theory (Granovetter, 1973) that the loosely connections' ability of benefiting the network.

4. Concluding remarks

This research focuses on the interaction of an informal discussion network enabled in social media. As a result, it paid attention to the discussion network of LinkedIn Group. The select discussion is defined as “successful” and outstanding from rest discussions, as it gains the highest degree of comments and still active at the time the selection was executing. These findings provide a way to build relationship between performance and structure of an interaction network.

These findings provide a way to build relationship between performance and structure of an interaction network. Especially the K-core analysis map and brokerage map (Fig. 2) responses the literatures of three characters, it shows this network has a quite broader boundary loosely coupled with the central core, the central core structure is distinctively stronger in connections than boundary's, and particularly the brokerage positioned participants very well demonstrate their role in efficient introducing new to the central core.

More findings are found on individual level. There is an inconsistency between the network analysis and content analysis has been found. The participants who are on the top of comments ranking does not has the highest level of Centrality. Another difference is found also between the contrast of the rankings in comments and Centrality. Some individuals have more connections than comments shows that their involvements are more collaborative; and some other individuals have more comments rather than social connections reflects their interactions are limited in a narrower group in the network. There is one individual high in Degree Centrality that reveals his activity in the network, and also distinct in Betweenness Centrality that measures the ability of control over the flow in the network (Freeman, 1979). These findings of functional roles on individual level re-outline three positions in this interaction network:

1. Collaborating: who manage to conduct collaboration involvements;
2. Generating: who contribute to generation information within the existing network; and
3. Controlling: who controls the network distance between the existing participants and new arrivals.

The findings articulate the network structure can be observed from a functional perspective and measurable by social network analysis. Because of these positions reveal more realistic working relationships tightly coupled with the performance of organizations or projects, rather than formal relationships (e.g. hierarchical or contractual relationship) in handling with information. Further analysis can be carried out from this perspective to understand what is really happened in workplace to complete tasks.

4.1 Limitations and further directions

The limitation of the research is not cover the examination of network tie strength, which is can be directly used to identify the core relationships or determine subgroups of a network. It is important to help to expend the unit of analysis to the subgroup-level to reveal discussion network. Another limitation is challenging the implementation of social media in a formal way to process information? Or it can be used to understand how such network relationships embedded in formal organizations to influence its performance? Comparison studies are significant to differentiate the

formal and informal network structures of inter-organizational relations on organizational-level in construction projects.

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Property and Project Management

Stakeholder's Influence to Improve the Construction Project Performance

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Abstract

Project stakeholders in an organization are the individuals who are actively or passively engaged in the project and who are also affected by the project management activities and the outcomes from the project. Targets to improve the project performance encourage the creativity and willingness of stakeholders to develop better ways to achieve the goal. Good management of stakeholders are critical if the project manager wants the people in the project team to pull in the same direction — towards successful outputs and outcomes. In this paper a generic descriptive framework is presented, showing how stakeholder's ability and influence impact on project management and project performance. The findings of a series of interviews with key informants are presented and the following main conclusion is drawn: improving project performance through stakeholder's contribution can strengthen the relationships between the project and its stakeholders. An innovative approach to defining the process of project performance improvement in construction projects is presented which will be of interest to those managing projects in practice as well as to those interested in advancing theory.

Keywords

Project Management, Project Performance, Stakeholder Engagement, Stakeholders Management, Stakeholder Performance Measurement, Stakeholder Risk Management.

Introduction

The construction industry is one of the most dynamic, risky and challenging business sectors. There is much waste and it encounters problems caused by myopic control (Mills, 2001; Vrijhoef and Koskela, 1999). A construction project consists with different stages that represent different processes and involve different parties as well as with different stakeholders. In this new global economy, engaging stakeholder is increasingly becoming a part of construction project practice to deliver excellent project outcomes. In the construction sector, scholars (Newcombe, 2003; Olander and Landin, 2005; Ei-Gohary et al., 2006; Olander, 2007) realized the importance of stakeholder management and paid more attention to it in recent years. This paper aims to improve project performance systematically through the involvement of stakeholders in the construction industry.

Involving stakeholder is a critical component of the initial project scoping phase and should occur before the project plan is formulated and consultations begin. A number

of researches had done on the perception of project success; but no one could achieve any static outcome. The aim of this paper therefore is to propose strategies for stakeholder influence in measuring the construction projects performance. The objective is to develop a framework that is considered necessary for successfully engaging stakeholders to measure the project performance. The paper is structured as follows: after this introduction, an overview of project stakeholder and project performance will discuss the contextual factors that contribute to improve the construction project performance. After that a research method and finally presents and discusses the results. This paper forms part of an on-going PhD study which is seeking to develop a framework for stakeholder involvement in construction to facilitate the improvement of project performance. It must lead to new knowledge and an improved understanding of the stakeholder's commitment in construction projects.

Who are the Stakeholders?

Stakeholder in an organization is any group or individual who can affect or is affected by the achievement of the organization's objectives (Freeman, 1984). Project stakeholders are defined as, individuals and organisations who are actively involved in the project or whose interests may be affected by the execution of the project or by a successful project (PMI Standards Committee, 2000). The conception of stakeholder has taken on greater importance due to public interest, greater coverage by the media and concerns about corporative governance (Mainardes et al., 2011). Stakeholders are important for a successful completion of the project because their unwillingness to continuously support the vision or objectives of the project leads many projects to fail.

Classifying the stakeholders is the first step of stakeholder analysis. The stakeholders in a project can be divided into internal and external stakeholders (Persson and Olander, 2004). According to Romenti (2010), stakeholders are considered social subjects who influence each other's perceptions, rather than isolated individuals who process information. Internal stakeholders are people who are already committed to serving the organization as board members, staff, employees and management and donors. External stakeholders are the people who are impacted by the organisation as clients/constituents, community partners, customers, competitors, suppliers and others. It is important to get the perception of both groups.

What are the project performances?

Measuring project performance is an integral part of project program. Measuring project performance depicts a clear picture of the condition of the project and provides confidence to the project teams. When a successful company invests time, money and other resources in a project, its primary concern is always what it is getting in return for its investment these projects stay on schedule and within their approved budget (Piscopo, 2012). To determine project performance expectations and measures, the project stakeholders must have a clear understanding of whole key project's plan and objectives. According to Atkinson et al., (1997), successful construction project performance is achieved, if stakeholders meet their requirements, individually and collectively. Measuring the project performance always keep the management prepared to take action quickly to get the project back on track if a project begins to run over budget or behind schedule so actions can. Performance measurement provides the project manager with visibility to ensure he is operating

within the approved time and cost constraints and the project is performing according to plan.

So, its vital to measure project performance to identify project strengths and weaknesses and where the management practices need to be improved. Performance measurement in construction focuses on performance in terms of time, cost, and quality (Ward et al., 1991; Kagioglou et al., 2001). Maximizing project performance the literature has recognized the theoretical importance of considering the interests of other stakeholders, besides the customer (Cleland, 1986; Karlsen, 2002; Mallak et al., 1991; Tuman, 1993). Stakeholders have the capability to influence the project and receive both project gain or lose. Successful completion of construction projects is therefore depending on meeting the stakeholder's expectation (Cleland, 1995).

Method

What is not clear though and is worthy of further investigation is how effectively stakeholder influence supports to improve project performance is construction. To investigate this issue an exploratory study involving in-depth structured interviews with UK-based practitioners representing some of the key stakeholders to a construction project were undertaken. As this was an exploratory study a small-scale and purposive sampling frame was constructed (see the Table 1).

Table 1: Profile of interviewees

Organization (UK)	Role of interviewee	Experience in construction and interview duration
Construction Company	Contractor A	40 years; 1 hour 30 minutes
Water and waste water services	Project Manager	30 years; 1 hour 20 minutes
Social Housing Company	Client Project Manager	30 years; 1 hour 8 minutes
House builder	Contractor B	38 years; 1 hour
Engineering, construction and technical services organization	Sustainability Consultant	7 years 6 months; 1 hour
Water and waste water services	Environmentalism	8 years; 1 hour
Water and waste water services	Contractor C	3 years; 45 minutes
Construction Company	Civil Engineer	8 years; 55 minutes
House builders	Developer	15 years; 1 hour
Engineering, construction and technical services organization	Design Engineer	37 years; 1 hour 10 minutes

A pre-produced list of questions was used as a tool for face-to-face discussion. Participants were asked to express both their experiences and their attitudes relating to

the importance and feasibility of involving stakeholder to improve the project performance on construction projects. The data analysis procedure involved converting raw narrative data (interview notes, audiotapes) into partially processed data (transcripts) which were then coded (with the aid of NVIVO software). Key steps in the stakeholder involvement process were then developed from the sub-themes that emerged from the coding process. The results are presented in the next section under the sub-headings drawn from the interview analysis under the theme “Processes for involving with stakeholders to improve the project performance”.

Findings and Discussion

This section presents a summary of the interview findings, with brief discussion, in relation to the interviewees’ attitudes and experiences related to the processes for involving with stakeholders.

Processes for involving with stakeholders to improve the project performance

In terms of involving with stakeholders the interview findings suggests a systematic process of following the key steps – which are amalgamated and shown in Figure 1. Figure 1 postulates that an efficient project team can be formed through successfully engaging all the project stakeholders. Once stakeholders are engaged effectively it makes easier to measure their performance, manage risk and relationship. Stakeholders can be managed properly when their performance is measured; risk and relationship are managed effectively. Good managed stakeholders are more devoted to improve the project quality, customer satisfaction, safety and reducing cost and time finally which drive to improve the overall project performance.

Efficient project Team

According to the Project Manager, “*Its obvious that to develop an effective project team, it needs to choose the best people for the job but determining the best candidates isn't always straightforward*”. An efficient project team understand how to work together effectively through the project scoping, planning and execution stages of the project. A project team is a works in a group or a unit with a common purpose through which members develop mutual relationships for the achievement of goals/tasks (Harris, P., R., Harris, K., G., 1996). The Project manager stated that “*.....we try to give our stakeholder feeling that we are working in a team to feel the sense of ownership of the project, analyze the project processes and commit to improving quality at every step*”. In a project there are many different skills are required and involving the right people go a long way to get the right outcome. In every project it needs to make balance between the project abilities with the business skills. To improve the project process its vital to engage those people who have appropriate business knowledge and skills of that process and who can understand project plans, aims and objectives. Measuring the stakeholder’s performance, managing stakeholder, stakeholder risk, stakeholder’s relationship helps to create an efficient project team.

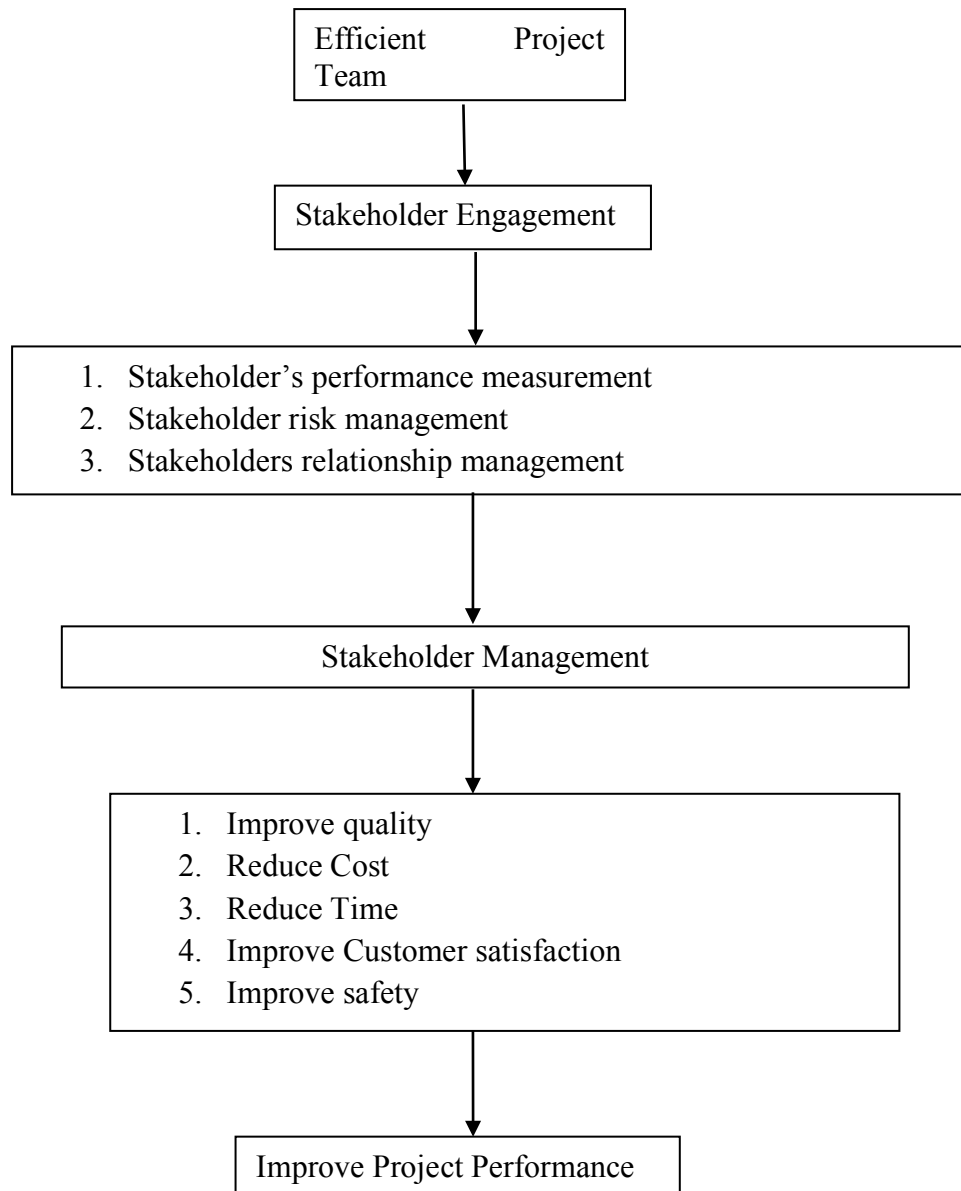


Fig 1: A framework for involving stakeholders to improve the project performance

Stakeholder Engagement Process

Engaging stakeholders in construction is a formal process of relationship management through which clients, contractors and sub-contractors engage with a set of primary and secondary stakeholders, in an effort to align their mutual interest to reduce risk on projects (Bourne and Walker 2006; Holmes, 2007). Some of the following benefits result from general stakeholder engagement for project success: better understanding of the market condition, as stakeholders often possess a wealth of information; promoting of reputation; building relationships; better learning the priorities and needs of stakeholders; building trust and long-term collaborative relationships; sharing experience and skills; understanding and mitigating the threats and uncertainties. Johansson (2008) states that stakeholder engagement helps deliver project success by enabling an organization to achieve its strategic objectives through involving both the external and internal stakeholders in the decision-making process. Through effective management, such involvement creates a positive relationship

amongst them. According to contractor C “.....engaging stakeholders from project planning to project implementation stage make sure the organisations that stakeholders are on the top of all issues and matters and they are the vital for solving problems”. Different stakeholders have different ideas, qualities, intelligence and knowledge. Involving stakeholders in their business models allows organizations to enhance their capability to deliver value in the project more efficiently. Romenti (2010) pointed out that it allows the organization to be consistent and maintain a temporal alignment between stakeholders’ expectations and organizational behaviour. Communication amongst the stakeholders on current or emerging project issues helps identify risk and develop appropriate plan in response.

Stakeholder’s performance measurement

Most of the interviewees agreed that performance targets that encourage continual improvement in terms of project performance need to be set up and stakeholders need to be engaged with the measures. According to the developer “.....we do measure the performance because it helps us to identify individual’s strength, identify the gap in their skills and as a whole identify the areas of opportunity for improvement”. The main purpose of performance measurement is to measure and improve the efficiency and the quality of the performance, and identify opportunities for progressive improvements in performance (Wegelius-Lehtonen, 2001). All key stakeholders’ individual performance needs to be measured to decide how well they are meeting their responsibilities to produce a better outcome for the project. Key Performance Indicators (KPIs) are used to measure the individual performance. One of the Builders described it as follows: “We have KPIs, we practice KPIs from our parent company to measure the social impact we make in areas. After identifying all of our stakeholders we set up their goals and also use KPIs to measure progress toward those goals”. Another Builder mentioned that “... we also measure performance indicators in terms of things like tenancy’s satisfaction [which relates to aspects of the TBL] - again we have that as a key driver”. For each measure, performance needs to be defined to identify the data to measure and to understand the important aspects that will effectively make up the action plan to ensure the right thing is measured in an appropriate way. One of the Project Managers described how they undertake “Customer Satisfaction Surveys” to measure their performance against their customers’ demands. Performance measurement, though, needs to be two-way, providing stakeholders with the opportunity to provide their own feedback, express concerns, help to identify problems early, such two ways communication will keep motivation levels at a high level. Participants mentioned the following KPIs which they use to measure their stakeholders performance.

Customer Satisfaction: Customer satisfaction is based on how the project fulfills the consumer’s needs and how the company is performing from the customer’s viewpoint. Customer satisfaction is made up of various components: technical quality and functional quality, functional and performance delivery elements, product, behavior and environment elements, direct and indirect elements, essential and subsidiary elements (Chu, 2002).

Quality Inspection: Quality is defined as the totality of features required by a product or services to satisfy a given need; fitness for purpose (Parfitt and Sanvido, 1993). Songer et al. (1996) and Wateridge (1995) proposed meeting the specification of the product for quality inspection and this specification works as workmanship guidelines

to contractors by clients or clients' representatives at the commencement of project execution.

Creativity: Creativity comes from people, who have a special set of characteristics for improvement that are different from others. Innovation is associated with creativity and change or is regarded as something new which leads to change (Dobni, 2008). An organization's overall innovative capability is to introduce inventive products to the market, through combining strategic orientation with innovative behavior and process (Wang and Ahmed, 2004).

Peer Appraisal: The performance of the stakeholders can be assessed by peer appraisal which is based on the ideas of many other associates, for example customers, suppliers, peers and direct reports. This peer appraisal could be assessed to get the team measure as well and this appraisal approach works as one of joint problem solving method and to maintain the good relations to enhance performance (Rowe, C., 1995).

Personal Knowledge: In order to deal with project complexity and to increase efficiency it's important to adapt good technical and social knowledge (Disterer, 2002). An individual's behaviour and performance depend both on the knowledge that has been acquired through learning, practice and experience and this knowledge provides an regulation to our lives which allows us to conceptualize goals, to anticipate and perceive events, and to respond in accordance with the changing needs, purposes and desires (Hunt, 2003).

Competencies: The assessment of competencies gives the employee a sense of what is necessary to perform at a higher level and what skills and capabilities are necessary to develop for success. Its important to have the technical and problem-solving skills of employees in total quality environments and employees must be able to work in teams to diagnose and solve problems (Yu and Ramanathan, 2012).

Stakeholder risk Management

As the stakeholders are a major source of uncertainty, a generic project risk management process framework provides a structure for a review of approaches to analysing stakeholders and risk management issues (Ward and Chapman, 2008). As each stakeholder usually has their own interest in the project that causes different priorities, conflicts and dramatically increase the complexity of the situation (Karlsen et al., 2008). So it is imperative to manage risk to manage stakeholders in construction. Risk mitigation and risk prevention are the top stakeholder risk management priorities (Orfano, 2009). According to Client Project Manager, *".....the more the top management knows about their stakeholders and their levels of importance and skills, the more effective and purposeful the risk management strategy will be"*.

Moreover, if the stakeholder's needs and apprehensions on project issues could be considered and recognised and also integrated them into the design and delivery of a project it will promote a project performance in construction sector. As outlined by Jenkins (2005), it is extremely important to involve stakeholders in all phases of the project, because their previous experience and their involvement in the project significantly increase the chances of success, by building in a self-correcting feedback loop. Involving stakeholders in project bring confidence in product and will greatly relieve its approval in target audience. Contractor A stated that *".....to get success and increase project value through sustained environmental, social and economic*

performance, an organisation must be capable of recognising and responding to risks”.

Stakeholder relationship Management

Managing stakeholder's relationships is essential to resolve concerns facing in project. By using their influence, stakeholders hold the key to the environment in which an organization operates and the subsequent financial and operating performance of the organization. Therefore the effective management of stakeholder relations is growing as a key focus of project and organizational activity. The mean of stakeholder relations management is to influence stakeholder attitudes, decisions, and actions for mutual benefit. The stakeholders need to gain from the relationship or they may not be sufficiently motivated to cooperate. It is necessary to understand relationships so as to engage in actions able to meet stakeholder demands on the organization and achieving organizational objectives (Mainardes et al. 2012). According to Sustainability Consultant *“When the relationship among the stakeholder is managed it will influence the stakeholder's attitudes, decisions and actions to the project for mutual benefit and they will more be sufficiently inspired to collaborate”*. Project success and failure is directly related to its stakeholders' perceptions of the value created by the project and the nature of their relationship with the project team (Bourne and Walker, 2008). McDermott and Chan, (1996) proposed a unified theory FIRMS (Flexible intelligent relationship management strategy) which is based on principle-centered relationships of sincerity, integrity, and trust. Stakeholder relationships are intangible assets and there is a significant body of opinion that identifies intangible assets as a major driver in the global economy, corporate survival and success (Phillips, 2006).

Stakeholder Management

Effective stakeholder management is crucial to project's success and it's really impossible to manage stakeholders if it's not known that who they are and what the motive of their involvement. Identifying stakeholders relative to their level of interest and power, provides an opportunity to bring those stakeholders within the judgment process who might have interest and authority to improve project performance and who might have interest in different project related issues as well. As most of the stakeholder's demands and interests sometimes conflict with each other, organization must set appropriate strategic goals and priorities to improve performance to meet these demands and interests. Accordingly, the extent to which management recognize their responsibility to meet and satisfy the needs and demands of their stakeholders' interests have direct effects on their overall corporate improvement (Johansson, 2008).

In order to manage the construction stakeholder's such as owner, contractor, subcontractor, construction clients, project manager and architects; stakeholder analysis can be used to identify the key people who have to be won over, according to their interest and power. However, Newcombe (2003) pointed out that different stakeholders have different levels and types of investment and interest and can be seen as multiple clients or customers for the project in which they are involved. Therefore most improvement actions were focused on increasing customer satisfaction. Contractor A stated that *“Lots of construction disputes and conflicts could be kept away from the organization if a communal stakeholder management*

approach is adopted by the parties". Stakeholder management is a proactive approach that stops things going wrong in the first time.

Stakeholder's Influence to Improve Project Performance

Stakeholders are the main controller of all the project activities so they are the key driver of the project success. When stakeholders are managed properly they are better organized to meet the needs of customers so that they are either more innovative in anticipating customer needs, more reliable in meeting customer expectations. Understanding the problem helps the efficient project team identify the correct strategies, the budget, the required resources and what constitutes success. According to the Design Engineer, *"we let our project team members know what they're supposed to do and the constraints on how they do face it"*. Communicating with stakeholders early and regularly make sure that they fully understand what is going to be happened and also understand the benefits of the project – this means that they can support actively when necessary. Active influence of stakeholders from project design to project implementation stage helps to keep track on whole project resources, cost, quality and time.

Stakeholder management, in a construction business project, works through a strategy. This strategy is created using information gathered through the following processes: Stakeholder's performance measurement, Stakeholder risk management and stakeholder's relationship management and these processes facilitates the stakeholder management process more successful and dynamic. For an innovation to be successful it is necessary to have close cooperation between stakeholders and the skills of the project team (Dulaimi et al., 2002; Gann and Salter, 2000). According to Contractor B *".....growing percentage of innovation is coming from outside the organization and not only from within"*. Participants realized that stakeholders are a resource and not simply a subject to get managed. Stakeholder management drives strategic direction with the operational excellence. According to the Client Project Manager *".....we do effort to engage our stakeholder to increase project support and reduce project costs and durations. Not only their involvement make it more likely that they will support but their input can also improve the quality of the project."* Stakeholder competencies are the combination of knowledge, skills, and behaviours that contribute to personal effectiveness (Lampel, 2001; Edum-Fotwe and McCaffer, 2000). Opinions from the most authoritative, effective stakeholders are important to shape the projects during the project planning stage. Stakeholder management involves taking into consideration the different interests and values stakeholders have and addressing them during the duration of the project to ensure that all stakeholders are happy at the end.

Conclusion

This study has identified a large body of stakeholder engagement processes with stakeholder performance measures that can be used by the top management professionals for the assessment of quality of their project programs, wellbeing, implication of reducing time and cost. Stakeholder engagement incorporating with the managing communication among them creates a mode to increases the project social and environmental performance (Adams and Frost, 2006). An integrated model is presented in this paper. This framework also outlines that the importance of stakeholder's management in order to keep the stakeholders united to improve the project performance (Cleland, 1986; Bourne and Walker, 2008). This framework is a

tool that can help the stakeholders together to increase comfort and quality of the project, while decreasing negative environmental impacts and increasing the economic sustainability. This framework helps to take in account the expectations and opinions about the project of the stakeholders among the internal, external and value chain stakeholders which helps to map the threats or opportunities to overcome different issues in project activities. Moreover, conducting with the stakeholders physically during the interview revealed the impact of their mutual interactions, reveal their common risks and uncertainties among their interactions and find out the way to erase those which have a negative impact to add value. To make the integrating process more effective this research could be expanded in future by focusing on validation of the framework through case studies like focus group discussion.

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Towards the Development of a Risk Response Model for Construction Projects Delays in the UAE

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Abstract

Within construction projects, there is a need for risks to be viewed from several different aspects, and for a perspective on how to ensure project success through such an approach, to be developed. The response to risk can only be effective in terms of controlling delays, if the entire risk management strategy is properly formulated and implemented within construction companies, and where applicable, in the organizations of stakeholders in the construction project. This research aims to identify the obstacles and challenges in respect of the development of risk response measures and their implementation, in construction projects in the United Arab Emirates (UAE). Two case studies are used to demonstrate that risks of delay can be managed by particular measures. Through these studies, it is shown that there was good indication of agreement in respect of the need for risk response development among contractors, project managers, and other engineers. At the same time, however, it was found that some construction stakeholders, especially clients and professionals in municipalities, are slowly accepting alternative management of risk response. A model for risk response development is then suggested on the basis of the two case studies and the analysis of pilot questionnaire responses.

Keywords

Delays risks, project management, risk response, UAE.

Introduction

Projects in most organizations are complex, and encounter delays risks. The complexity associated with these projects requires investigation in order to better manage and control the risks involved. In this matter, many organizations attempt to manage their risks within the first phase of the project risk management loop in risk control (describe and report the risk through interviewing, brainstorming, check listing). This phase is critical in risk management, and indeed it underpins project success (Elkjaer et al., 1999). The second phase in the risk management loop is the assessment process, which deals with the quantification and prioritization of risks (Cooper and Dale, 2005). And the third phase is risk response, which is involved with choosing the strategy from many possible risk strategies by considering the degree of prediction and influence to control the risk (Elkjaer, 1999) (see Figure 1).

This paper deals with delay risk response in the construction project sector with the United Arab Emirates (UAE), where to date there has been no real success in managing delay risk. Furthermore, whilst many studies have been undertaken in this field, they have been in quite different environments, and have reviewed the issue of risk response applications, tools and techniques, purely in order to determine the

causal factors and effects (Motaleb and Kishk, 2011), rather than to learn what brings about risk response success (Hällgren and Wilson, 2011). Consequently, it can be appreciated that the management of the outcomes from each category-related cause of delay risk may require risk response development rather than the traditional management, and accordingly, there would be a need to make certain priorities for the risk response success planning. The objective of the research that underpins this paper is to identify measures prior and during construction, to develop risk response strategies for project success, and then to outline a model. The outcomes can be generalized to construction projects within the UAE and the region.

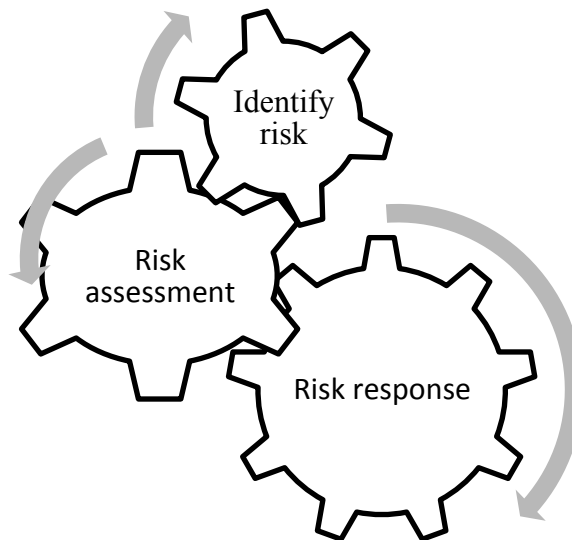


Fig. 1: Risk management control loop (Elkjaer, Coopers, and Felding, 1999)

Risk Response

All projects are unique in respect of their content and scope, but nonetheless, there are certain inherent risks that pertain to them all, and unexpected changes can occur with any project. Risk response has been discussed and classified in systematic management standards to be of the ‘acceptance’ type or the ‘reduction’ type, it being suggested that ‘acceptance’ should be the strategy if the risk impact is relatively insignificant (using a contingency plan) and it is possible for mitigation, and that ‘reduction’ should be adopted where immediate action is required, and that in this reduction activity, the costs, savings and benefits should be compared. Elimination of risks is obviously preferable where such risks are unacceptable, but in reality it is impossible to totally remove such risks. Risk response is not usually cost effective because projects face unexpected changes varying from simple to chaotic changes or variations (De Meyer et al., 2002). One further option exists, that being to transfer the risk to another party, and in this case it should be transferred to the party most capable of managing it. This act of transferring a risk is seen in the work undertaken by Zhi (1995), who observes risk response to be dealt with through the three channels of: response by contracts, by retention, and by insurance (Zhi 1995)

Clearly, the formal identification and discussion of these types of response indicate the importance of the issue, but in fact research in the area of risk response is still neglected (Syedhosini et al., 2009), and this is a situation that should be redeemed since reduction, protection, contingency, acceptance, and transfer types (Risk

Management Guidelines, 2003) are all known to affect the overall strategy of the project, albeit in limited areas of risk (APM, 2006).

In the UAE, the impact associated with delays risks has been attributed to two factors, these being: 1) Limited research in risk management, and 2) Traditional management used by construction companies to deal with risks. However, the global financial crisis of 2008-9 was (and remains) a major delays risk, and little understanding has emerged as yet of the extent of the influence occasioned by the financial crisis, on the delays experienced in projects. At the same time, it can be said that few studies in construction management have concerned themselves with exploring how a more developed approach to project management rather than the traditional one, could be more valuable (Wysocki, 2009). Certainly, it is reasonable to expect that all stakeholders in construction projects should possess sufficient knowledge to enable their effective participation in decision-making, yet their experience of contributing to risk management efforts is limited because of the emphasis on the traditional approach that excludes them, and limited estimations of expected risks. In particular, the quantified risks like change orders, on-time performance, would benefit from such inputs since the traditional project management approach omits these completely, and hence, does not consider the potential for change nor the way to deal with it. Additionally, the traditional management technique has failed to ensure that the most appropriate tools for evaluating the way to respond to risk are used. Moreover, the need for an appropriate risk response is paramount when the effect of the risk materializing is to exceed the budget and time allocated for the project. Hence, it is important to take action (Syedhosini et al., 2009) to avoid the risk occurring and possibly having to terminate a project. Mitigation of unexpected changes does not often enable the decision-maker to define the outcomes because of the risks variations itself.

Under the umbrella of traditional management, chaos has occurred, and in this extreme situation, epistemic risks arise, as was the case specifically during the financial crisis between 2008 and 2010. This epistemic risk resulted from a lack of knowledge, lack of team co-operation, very slow decision-making in attempts to control the risks, and hence delays in responses (Imbeah and Guikema, 2009; Chua, 2009). It is, therefore, essential to produce detailed preventive measures and pre-tested contingency plans (Risk Management Guidelines 2003), since they are valuable in combating risks, particularly at the early stages (Thompson and Perry, 1992).

It is clear that both preventive and mitigation measures are useful, and indeed commonly used in the development of a risk response plan, but there are differences in their cost, and the mitigation route is identified as the most expensive (Cooper and Dale, 2005). Hence, it is advisable for clients to take responsibility for each agreed risk response (Burtonshow, 2009), and to deal effectively with risk severity for cost effective, time success, positive procurement, quality, and schedule plan outcomes (Sanghera, 2010). And given this need, contemporary research on adaptive management for effective risk response within the risk management process must properly define and develop the concept of risk response. In 1997, Taylor and his colleagues were involved in learning from experience to respond to risks, and assessing the relevant assumptions made in light of that experience. They entitled this approach 'adaptive management' and in several disciplines such as environmental management, this has demonstrated itself to offer a more successful model than traditional management (Murray and Marmorek, 2004), and one that recognizes the value of the various stakeholders' knowledge in its decision-making (Lal et al., 2001).

Given the widespread applicability of this approach, there is no reason why action levels for risk response in construction should not be defined, since the approach would enable the identification of risks during monitoring and allow for adjustments to be made before a genuine response were necessary. With the use of adaptive project management in construction, improved risk response outcomes can be obtained, and hence, improved productivity will follow.

Knowledge Gap and Research Focus

Having reviewed the literature relevant to successful risk response management it appears that there is no associated model in the process of development, which is an omission since such a model would enable project managers to determine the ability of stakeholders to enhance opportunities and reduce threats in projects. More specifically, a risk response success model would bring the potential to create the essential conditions for optimal risk identification and assessment that would in turn allow project managers, contractors, consultants and clients to establish whether a risk has changed in nature, increased or decreased, and then monitor and control its effect on delay.

In the view of this research gap, this study explores the measures within construction companies concerned with successful risk response, and validates these measures through a case study methodology. The focus of the research is illustrated in Figure 2.

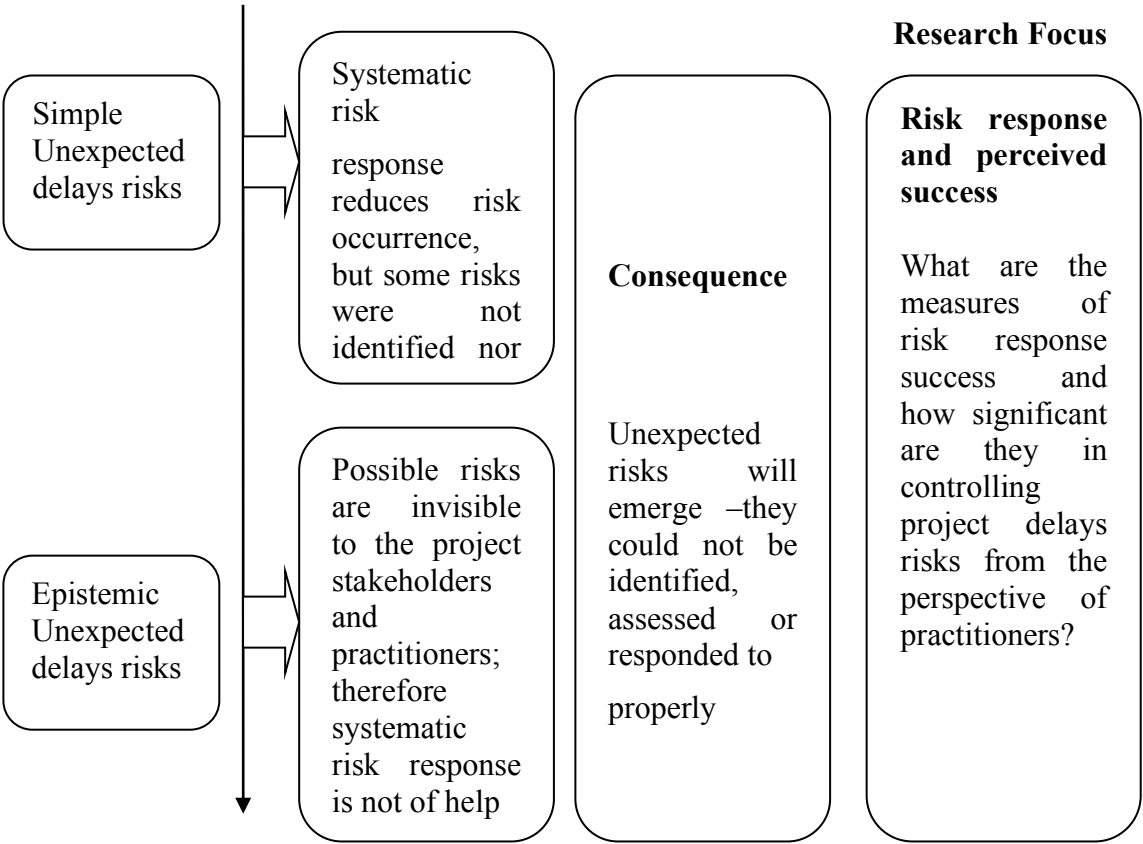


Fig. 2: Focus of the research

Research Methodology

The research method involved a literature review that was relevant to risk response success measures, and a questionnaire related to two case studies. The questionnaire was conducted with sixteen engineers, project managers and managers in a construction company on a face-to-face basis and by e-mail. Documents and direct observations are used in the two case studies for validation. The questionnaire approach may be used when more quantitative data is needed. The SPSS programme was used to analyze and help in the presentation of the data, which in itself contributes to the development of a model for the case studies.

Case study 1: A scoping study

As part of the development of the country, the Abu Dhabi Government is implementing various projects/programmes to enhance public living standards in the different regions of Abu Dhabi, the capital of the UAE. Housing development projects undertaken by a governmental general services company and a construction company, both with over 140 employees, annual turnover of more than \$5 million, a contract value of \$30 million, and a two-year duration of the project, were the focus. The work involved is the construction of 60 villas. It is noted that the client (the government) changed the specification for the rooms within these villas after securing more information concerning the size of the families that are expected to occupy these villas, so that all of them had to be internally modified to enlarge the rooms, and this had to be done when more than 50% of the work on the villas had already been completed. After the client's approval, the relevant documents must be submitted to the appropriate authority to obtain the building permit. As shown in the research focus in Figure 1, this case appeared as simple unexpected delays risks but time completion will exceed huge limits (changes after 50% of work completed). Systematic risk response can reduce risk occurrence, but this such risk cannot prevented properly.

Case study 2: A scoping study

In addition to the work detailed as Case Study 1, the infrastructure must also be provided so activities such as site grading/leveling, sewage works, storm water works, potable water works, electrical work (including the building of a sub-station, and street lighting), road works (including road signs and road marking etc.) are all included within the scope of the work. This represents Case Study 2. The cost and durations as planned were: site Grading – Dhs 5,792,918 Duration 90 days, Sewer Line – Dhs 16,113,926 with a duration of 110 days, Potable water line – Dhs 4,483,704 with a duration of 120 days, Storm water line – Dhs 8,634,283 Duration 60 days, Road works – Dhs 21,543,675 a with duration of 130 days. Additionally, there is all the planning, procurement management, execution, and stakeholder management to be considered and effectively delivered. The delays caused in mobilization for grading and leveling mismanagement (see Table1). Back to the research focus in Figure 1, the case is categorized as Epistemic Unexpected delays risks, possible risks are invisible to the project stakeholders and practitioners; therefore systematic risk response is not of help. The traditional risk management extract for Case study 1&2 (company documents) as presented in Table 1, indicates the consequences of the delay, the traditional risk response and the researcher suggested the risk response development in the fourth column.

Table 1: The Traditional Risk Management Extract for Case Study 1& 2

Causes of Delay	Consequence of the delay	Traditional Risk response	Preventive-Mitigation measures for
Change order by client (Case study 1)	Construction of villas cannot start before obtaining the building permit	Client and Consultant should approach the relevant Authorities in order to expedite building permit sanction	Risk reduction
	All the constructed villas have to be modified as per the revised design after obtaining the revised building permit	It is a major risk, Client has to co-ordinate with the end user requirement before proceeding with the building permit	Risk absorption
Lack of site management (mobilization) (Case study 2)	Sewerage line design changed. Subsequently other infrastructural works also delayed since sewerage line in more deeper than other utilities	Contingency plan for design change (plan B) should be provided on time	Rick avoidance and Risk absorption
	Sewerage line obstructed by Existing Villa Owners. Subsequently all the construction activates of Sewerage line delayed	Early communication with end users.	Rick avoidance

Findings

This section reports the results of the questionnaire administered to understand the measures for risk response development according to the two case studies.

- In respect of their professional roles, 44% of respondents were contractors, 25% were project managers, 6% were consultants, and 25% were other engineers (Figure 3).
- Twenty-two preventive measures (prior-construction) and fifteen mitigation measures for project success (during construction) were identified from the literature and from the pilot questionnaire using a three-point Likert Scale. The preferred measures as indicated by the respondents were 1= least recommended, 2 = recommended, and 3 = highly recommended.
- In respect of the preventive measures (prior-construction), the top success measures as identified by the respondents (considered to be highly recommended and recommended) are shown in Table 3.
- In respect of the mitigation measures during construction, as shown in Table 4, the respondents indicated a new core for risk response developing measures as follows in Table 4:

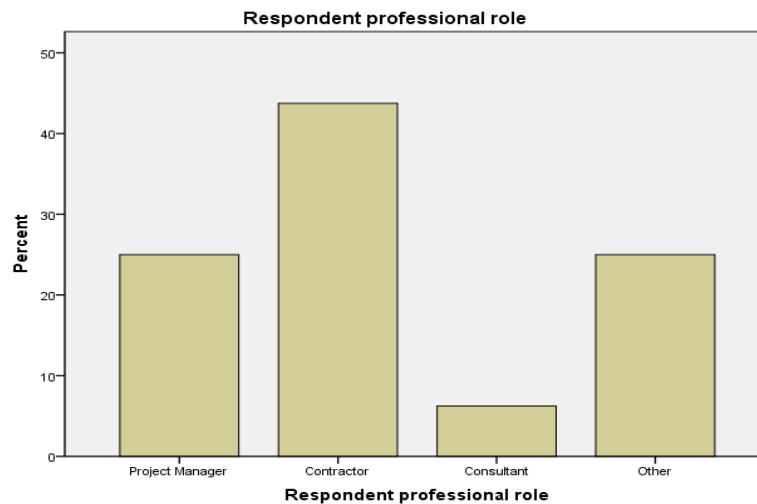


Fig. 3: The questionnaire respondents by job description

Table 3: Top Factors of Preventive Measures to Control Delays Risks (prior to construction)

Preventive measure	Percentage%	Likert Scale
More anticipated risk identification	62.5%	Highly recommended
Prepare a programme from previous experience observing the effect of the financial crisis	50%	Highly recommended
Contingency plan development	62.5%	Recommended
Improve decision-making support system	62.3%	Recommended
knowledge in product positioning and market success-technological development for market competition	56.3%	Recommended
Significant share with stakeholders' - effective communication	56.3%	Recommended
High share impact risks with other stakeholders (risk owner)	56.3%	Recommended
Proper quantitative and qualitative risk analysis	56.3%	Recommended
Prepare advance programme from past learnt projects under financial crisis effects	50%	Recommended
Develop knowledge base for planners	50%	Recommended
Develop contract performance	50%	Recommended
Develop labour knowledge	50%	Recommended

Proper risk management training	50%	Recommended
Appropriate project team training	50%	Recommended

Table 4: Top Factors of Mitigation Measures to Control Delays Risks (during construction)

Mitigation measure	Percentage%	Likert Scale
Develop change management (in variations)	56.3%	Highly recommended
Exchange of adequate incentives and rewards -between contractors and clients	56.3%	Highly recommended
Use past lesson learnt	50%	Highly recommended
Up-dating project schedule for identifying any new risk	50%	Highly recommended
Manage the overlapping activities considering budget and schedule	73.3%	Recommended
Delay risks re-analysis	62.5%	Recommended
Proper plan for optimal risk allocation	56.3%	Recommended
Increase project team productivity – resources (Expert manpower/efficient equipments/ technology) - risk buffering	56.3%	Recommended
Improve Municipality inspections process for change requests	50%	Recommended

Discussion

The findings supported the review of the preventive and mitigation measures for risk response development in the literature and the findings of the questionnaire completed by the respondents from both case studies support the contention that both types of measure are important when considering project risk response development, prior to and during construction. Particularly of concern to the respondents in both case studies was the fact that some unexpected risks were truly incapable of being predicted and that these cause certain difficulties. They claimed that it was difficult to recall unexpected events that had a significant impact on the project and that had not been identified in advance as potential risks. The simple unexpected risks may have been identified as possibly existing but they did not know whether these would occur. On the other hand, as shown in the research focus in Figure 3, unexpected epistemic delays risks formed the most significant risks and were believed to warrant consideration in the first place.

Contractors, project managers and other engineers were agreed on the need to develop preventative measure for risk response development for the two case studies by developing the traditional extract for risk response in Table 1 and 2 by spend more time in trying to i) anticipate risks identification taking into account their previous

experience, and ii) the known effects of the financial crisis, these measures are highly recommended followed by other measures were: contingency plan development, improvements in the decision-making support system, gaining knowledge in product positioning and market success - technological development for market competition, high shared with stakeholders' effective communication, sharing the impact of risks with other stakeholders (risk owner), gaining accurate knowledge of performance, proper quantitative and qualitative risk analysis, and the preparation of a programme using the knowledge gained from previous projects that have been undertaken in the period of financial crisis. In addition, they deemed it necessary to develop a knowledge base for planners, one concerning labour, learn about contract performance, and provide proper risk management training. By considering all the previous measures the practitioners expect to gain the ability to identify the many possible risks and develop any type of risk response (reduction, absorption or avoidance). However, it is accepted that unexpected epistemic risks may be hard to identify in specific terms.

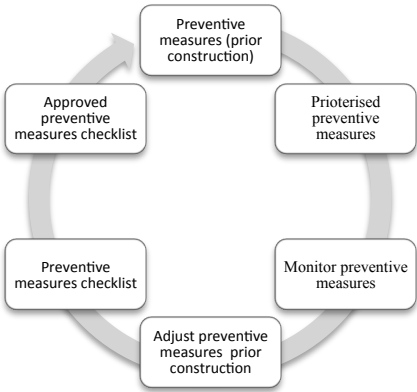


Figure 4a: Adaptive management for preventive measures for risk response development (Stage 1)

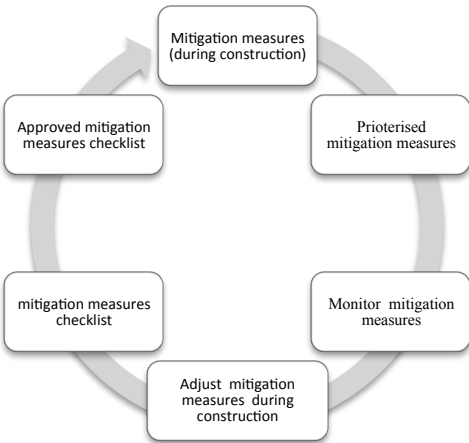


Figure 4b: Adaptive management for mitigation measures for risk response development (Stage 2)

In respect of the descriptive mitigating measures during construction, the respondents indicated the need to develop a risk response for simple unexpected delays risks by

controlling the extent to which change orders from clients are accepted, and by considering the exchange of appropriate incentives and rewards between contractors and clients. In fact these measures were highly recommended. In addition, the respondents insisted that it was necessary to learn from past experience, and to continually update project schedules in an effort to highlight the potential for any new risks and institute avoidance mechanisms. Other measures were also recommended such as effective management in the overlapping activities, greater consideration of the budget and schedule, ongoing attention to potential delays, and proper planning to ensure the optimal allocation of risk. In terms of buffering risk, respondents felt that measures should include increasing project team productivity by ensuring that the proper resources (expert manpower/efficient equipment/technology) are available since this would enhance the risk response strategy, and that there should be a municipal inspection process for change requests that should bear in mind the requirement for contractors to manage their time effectively and efficiently. Accordingly, the traditional management approach to risk identification and response should be changed, and a new core to the process that ensures adaptive management be applied to ensure more effective risk response development. A model is suggested as shown in Figures 4a, b, and c (prior to, during, and the final stage of, construction).



Figure 4c: A model for construction project risk response development

Conclusion and Further Work

The study contributes to risk management discipline, supported the argument for risk response enhancement in by stakeholders and hence, in the execution of projects. The use of the adaptive model can be perceived as valuable in bringing success to a project through its application of two identified measures that could improve the nature of project stakeholders’ performance and decision-making in respect of both simple and epistemic unexpected delays risks. The first set of measures are those described as preventive and should be introduced in the pre-construction stage as a result of more concentration on the risk management control loop to the elements of

identification, assessment, and risk response. The findings from the questionnaire and the two case studies have stressed to develop a model enabling the identification of risks and of risk response measures prior to construction, and encompassing the need for previous experience to be used in this model. The effects of the financial crisis should be fully understood and incorporated such that delays risks can be considered well in advance and controlled. The second set of measures are those described as mitigation measures, and these involve the development of change management (variations), such that particularly in cases where clients request excessive changes as noticed from the two case studies, there is an adequate exchange of incentives and rewards to ensure that contractors are not disadvantaged. Building on the knowledge gained from previous experience, these two success measures should be cycled in an ethical way throughout the adaptive management approach.

This study has identified a number of interesting aspects in the risk response management of construction delays in the UAE, which in themselves are large in number and require a more appropriate response for their control. It has shown that both the literature and the findings of the two case studies call for risk response development in an effort to bring improvements to traditional management approaches by the introduction of adaptive techniques. The resulting new adaptive management model should have as its core, approved preventive and mitigating measures development as shown in stages 1 and 2 of the suggested three-stage model. In developing the model, the three stages are identified as relating to pre, during, and post construction. At the pre- and during construction stages, there is the opportunity to identify and finalize client goals and the method of stakeholder management. At the post-construction phase there is an evaluation of all the outcomes, from which knowledge can be banked to be used in risk response management for future projects.

A limitation of the current study is the small number of questionnaire respondents in each of the two case studies and the difficulties associated with some professionals in finding time to participate. There remains a need to investigate further how project 'success' is achieved, particularly in relation to developing risk response strategies in construction companies in the UAE, and the change management process by developing risk response in project management maturity levels to achieve high levels for delay risks control. This study is a part of ongoing PhD research.

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An Investigation of The Status of The Saudi Arabian Construction Industry

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Abstract

Saudi Arabia has been experiencing a construction boom for the past four decades. Currently, the industry is lacking performance measurement systems. These systems are critical in order to identify areas of improvement needed. The aims of this paper are to identify how the construction industry in Saudi Arabia is currently being measured, and the critical success factors (CSFs) on its performance. Further, it briefly investigates the challenges that face the Saudi construction projects. The first step towards achieving performance improvement is to understand current performance by looking at structured methods of performance measurement. Thus a credible method of construction performance measurement is required for achieving any sustainable performance improvement. Benchmarking and Key Performance Indicators (KPIs) are widely seen as such credible methods. The research focused on qualitative methods that examine people's words, behaviour and actions in descriptive ways and more closely represents the situation as experienced by participants. Interviews were conducted to investigate aspects of Saudi construction performance measurement. The outcome showed that the Saudi construction performance is being measured through both financial and non-financial measures. Several internal and external factors influence the performance of the construction projects. The lack of qualified resources is the main barrier facing the industry towards establishing performance measurement systems. However, a more structured approach to performance measurement, through model creation, is required.

Keywords

Benchmarking, construction, critical success factors (CSFs), key performance indicators (KPIs), Saudi Arabia.

Introduction

Saudi Arabia has the largest construction market in the Middle East, with multi-billion pound projects in both the public and private sectors. The key dynamics stimulating both public and private sector investment in construction projects are population growth and the strong increase in oil revenues (Oxford Business Group, 2010). Currently, the Saudi construction industry is lacking performance measurement systems (Bannan *et al.* 2012). These systems are critical in order to identify necessary areas for improvement. Kaplan and Norton (1996) state that the first step towards achieving performance improvement is to understand current performance, by looking at structured methods of performance measurement. Thus, a

credible method of performance measurement for construction is required in order to achieve that.

One of the most debated and controversial topics about Performance Measurement Systems (PMS) is the impact that PMS implementation and usage have upon business performance, in terms of clear, tangible results. There is not much related work in the Saudi context, although KPIs have been well established in certain contexts. Martinez *et al.* (2004) state that the little body of research on this topic, as reported mainly by consultancies and commercial research companies, has two limitations: the lack of a strong methodological basis and a quantitative approach that lacks explanations regarding results.

The aims of this paper are to investigate the performance of the Saudi construction projects using measurement systems such as benchmarking and KPIs. Moreover, it will explore how Saudi construction performance is currently measured, and the influencing factors that impact on the achievement of improvements in business results.

The Construction Industry

This section helps in establishing the base for the construction industry by capturing learning from the UK. According to Green (2011), the construction industry is not a homogeneous entity. There is a continuing debate about the boundary definition (Pearce, 2003) and that construction is not a single industry, but several separate sub-industries (Ive and Gruneberg, 2000). Emerson (1962) and Banwell (1964) use the term 'construction industries' in the plural, whereas Latham (1994) and Egan (1998) use the term 'construction industry' as if it were a single entity. Green (2011) argues that the modern practice is to refer to use the term 'construction sector'. The narrow definition of the sector *"limits itself to on-site assembly together with repair and maintenance activities carried out by contractors and excludes those involved in professional services such as surveying, architecture and engineering"* (Green 2011, p. xvii). However, professional services and construction material suppliers are included recently within the boundary of the construction sector for the purpose of improvement debate (Green, 2011). According to Irurah (2001), construction can be interpreted at four levels: as site activity, as the comprehensive project cycle, as everything related to the business of construction and as the broader process of human settlement creation. The Chartered Institute of Building (CIOB) defined construction management (CM) as one of a family of disciplines concerned with the complex phenomenon known as the 'Built Environment' (BE). The planning, design, production, adaptation, maintenance, restoration, conservation, management, evaluation and recycling of the built environment requires interaction between disciplines, just as healthy living requires multi-professional support. CM is exercised at a variety of levels, from sites and projects, through corporate organisations, clients and whole communities (Bale and Shirong, 2009). The Office for National Statistics (ONS) (2011) classifies the industry according to the size and trade of firms. Size of firms is measured by the number of employees, whereas firms' trade is divided into main and allied trades. Green *et al.* (2004) conclude that the construction sector is highly fragmented with many customers and is dominated by a large number of small firms. The fragmentation of the sector provides flexibility to deal with highly variable workloads. On the other hand, it has many disadvantages. The extensive use of sub-contracting affects the contractual relations and prevents the continuity of teams, which is essential to efficient working. Inadequate communication, coordination,

integration and resistance to change are all a result of the fragmentation. Moreover, the construction sector suffers from individualistic players trying to perform jobs in their own way, which are not willing to commit to any group activities and are lacking innovative ideas. Latham (1994) and Egan (1998) state fragmentation as one of the problems for the construction sector that inhibited its performance.

The Construction Industry in Saudi Arabia

The Saudi Arabian construction industry basically consists of the public and private sectors. *"The public sector pertains to the government ministries responsible for infrastructure and national development projects, while the private sector comprises the construction firms privately owned or subsidised either by a family corporation or a conglomerate"* (Al-Sedairy, 2001, p. 162). In the late 1960s, Saudi Arabia had almost no infrastructure at all, apart from the traditional methods of buildings. Since then, a hundred billion pounds have been spent to promote the construction industry. The industry experienced a boom, as projects were initiated and completed across all construction types. *"The skyline of the main cities in Saudi Arabia no longer belongs to palm groves, but to steel towers and economic clusters. With billions of pounds in oil windfall, the Kingdom has turned into an oasis for construction. Moreover, its companies are exporting their expertise"* (Business week, 2006).

Uncertainty is identified as an existing element in the nature of the construction business. This may be because of different factors, such as the nature of the industry itself, competitive bidding, the workforce, changing demand and distinctive management approaches. The Saudi Arabian construction industry is no exception.

The construction industry in Saudi Arabia has enormous challenges and opportunities to face in the future, for instance, to complete the several projects announced and to create economic cities, as well as to absorb increasing demand for residential buildings. Moreover, there is hope for the construction industry in the government's enhanced commitment to the private sector and to its firm commitment to the principle of privatisation. The willingness of Saudis to invest in their own country also demonstrates the bright long-term future of the construction industry (Al-Sedairy, 2001). However, despite all the recent developments in the Saudi construction industry, there is still no system to assess the performance of construction projects (Bannan *et al.* 2012).

Performance Measurement Systems

Performance measurement is the process whereby an organisation establishes the parameters within which programmes, investments, and acquisitions are reaching the desired results (Office of the Chief Information Officer (OCIO) Enterprise Architecture Program 2007). Neely *et al.* (2002) define performance measurement as the process of quantifying the efficiency and effectiveness of past actions. A key part of a performance measurement system (PMS) is the use of results to aid the decision-making process (Beatham *et al.* 2004). From 1998 to 2009, the reviews of performance measurement studies in construction concluded that research in this area has focused on three levels: the project level, organisational level and stakeholder level (Yang *et al.*, 2010).

According to Neely (1998), there are multiple reasons for organisations to measure performance. These reasons can fall into one of four categories:

1. Checking position. Monitor the progress over time and be aware of current status.
2. Communicating position. The need for releasing annual reports by construction firms either as a requirement or as a means of marketing themselves.
3. Confirm priorities. Performance data allow organisations to identify shortfalls and help them focus on priorities for actions.
4. Compel progress. Performance measures can help the organisation focus on specific issues and encourage people to search for the best ways to improve performance.

Beatham *et al.* (2004) state that performance measurement is only part of a system and that the various models and theories have been developed over the years to assist in the use of measures as part of an overall system. Table 1 displays examples of previous studies on organisational performance measurement in the construction industry. The researchers provided guidelines for the implementation and use of PM systems, which can help in developing a framework for the Saudi construction projects.

Table 1: Different studies of performance measurement in construction

Researcher	Study
Kagioglou et al. (2001)	Performance measurement process framework (PMPF) based on the BSC with the addition of two perspectives, namely 'project' and 'supplier', which can be adapted for any organisation
Stewart and Mohamed (2001)	BSC framework allowing for the measurement of IT/IS performance. The writers used a project tier example to illustrate the application of the proposed framework
Samson and Lema (2002)	Conceptual PM framework and proposed a set of effective indicators for Tanzanian contractors
Costa and Formoso (2003)	Framework to identify gaps and best practices in the PM system which is compatible with the construction firms' strategy in Brazil. The researchers provided guidelines for the implementation and use of PM systems.

Benchmarking

Benchmarking is one of the most powerful tools for initiating and sustaining continuous improvement (Ali *et al.*, 2010). The European Commission has been a strong advocate of the benchmarking process. Since the mid 1990's, it has led a number of benchmarking initiatives in response to requests for guidance from the construction industry (Commission of the European Communities, 2003). Watson (2007) defines benchmarking, in simple terms, as "*a process of comparing in order to learn how to improve*" (Watson 2007, p.3). Similarly, Camp (1989) defines benchmarking as "*the search for industry best practices that will lead to superior performance*" (Camp, 1989). This definition emphasises the value of the learning of best practices (internally or externally) for the purpose of achieving superiority or competitive edge over competitors. According to Lo and Fong (2010), best practices are part of the knowledge distillation process. Best practices are built upon experiences and lessons learned. After capturing the experiences and lessons, learning

are then distilled into best practices through discussion and debate with individuals with knowledge in the field (Lo and Fong 2010).

Key Performance Indicators (KPIs)

Key performance indicators (KPIs) are quantifiable measurements that reflect the critical success factors of an organisation. KPIs can be used to evaluate performance, the results of an activity, current status or results of a process (Takim *et al.*, 2002; Cox *et al.*, 2003). Chan and Chan (2004) posit that KPIs are general indicators of performance that allow focus on important aspects of outputs.

In the UK, following the specific targets for improvement set in the Egan report, the Movement for Innovation and the Construction Best Practice Programme (CBPP), both government-funded, were launched. The CBPP is one of the leading organisations involved in generating KPIs for the industry as well as introducing the subject of performance measurement. Other organisations include Movement for Innovation, Housing Forum, Major Contractors Group (MCG), National Contractors Federation, Design and Build Foundation, Association of Consulting Engineers (ACE), Architectural Practices benchmarking and the Construction Round Table (Beatham *et al.*, 2004). There are different applications of KPIs in construction. Table 2 shows the varied applications of KPIs in recent years.

Table 2: Different applications of KPIs in construction

Researcher	Study
Chan and Chan (2004)	Developed a set of KPIs to measure success of construction projects. The researchers used three cases to test the validity of the proposed KPIs
Beatham et al. (2004)	Suggested a framework for a performance measurement system including all types of measures and aligning to the company's strategies and objectives
Shohet (2006)	Proposed a set of KPIs for the tactical maintenance management for healthcare facilities
Yeung et al. (2008)	Developed a Partnering Performance Index (PPI) for construction projects in Hong Kong. The PPI can assist in developing a benchmark for measuring the performance of partnering projects. The authors established a set of Quantitative Indicators (QI) in order to measure the most important KPIs

The above literature implies that little effort has been devoted to the development of a comprehensive framework for measuring the performance of construction projects in developing countries, such as Saudi Arabia, based on the learning from developed countries (i.e. UK). Moreover, the majority of studies used questionnaire as the primary data collection instrument. Questionnaires have many disadvantages, such the

low response rate, lack of opportunity to clarify respondent doubts and no control over the speed with which participants return the completed questionnaires.

Research Methods

The research method of this study consists of the philosophical position of the research, the research purpose and instrument used to investigate the performance of Saudi construction projects.

Ontological orientation: constructionism

The constructivist approach appears to be the best ontological orientation for the research purpose of exploration. The performance of the Saudi construction environment is believed to be socially constructed.

Epistemological orientation: phenomenology

The phenomenological approach appears to be the best epistemological orientation for the research purpose of exploration. Ideas about the performance of Saudi construction should be developed through the induction of data. The intent is to explore how respondents' attitudes are shaped by understanding the words and the meanings they allocate to them. An attempt is made to understand Saudi construction phenomena in depth and not to prove or verify any theory.

Methodology: qualitative

The research focuses on qualitative methods, examining subjects' words, behaviours and actions in descriptive ways, and more closely represents the situation as experienced by participants (Maykut and Morehouse, 1994). The holistic nature of qualitative methods is thought to be useful for the purpose of understanding the performance of the Saudi construction projects. The researcher will take part in the construction of data to better understand the phenomena under study and to provide detailed description.

Research purpose: exploratory

The research aims to explore how the performance of the Saudi construction projects is measured, and how the use of KPIs and benchmarking develops a model to measure Saudi construction projects, with a view to obtaining new insights. Therefore, the exploratory method best suits the aims of the research.

Research instrument: semi-structured interviews

Semi structured interviews were chosen as the primary research instrument, because they help better understand how individuals construct meaning and significance in their situations from a personal point of view. They are a flexible and adaptable approach to exploring the Saudi construction industry in conversation. They allowed the researcher to focus on specific topics, while also allowing the respondents to share project information and current challenges in an open environment. Moreover, they provide the opportunity for further discussion and exploration of thoughts and ideas as they proceed.

Respondents

Respondents were carefully selected from among those with knowledge and experience in the field and understanding of the subject under research (Easterby-Smith, 2008). Valentine (2005) explains that, unlike with most questionnaires, "the

aim of an interview is not to be representative but to understand how individual people experience and make sense of their own lives" (Valentine 2005, p.111). In order to ensure that they had relevant experience to address the questions, a number of decision makers were chosen to be involved in performance measurements. Participants who worked at various levels in the project organisations were selected. Each interview ranged from a minimum of forty five minutes to a maximum of two hours with certain participants. They were all Saudi nationals working directly in organisations involved in both public and private construction projects. Moreover, they were selected to represent different parties in the industry with different qualifications and expertise: firstly, a policy maker working for the government, secondly an owner of a private consultancy company and thirdly a concrete (material) supplier. The fourth interviewee is the head of the construction projects department at a University and there are two consultants with different expertise and a construction engineer working for a well known contracting company. The interviews were conducted during the time of the projects in order to obtain as much reliable data as possible.

Table 3: Interviewees information

Construction party	Code	Qualification	Expertise	Experience / years
Supervisor general of projects	KSA1	PhD	All Engineering projects	25
Consultant	KSA2	MSc	Architectural and CM	17
Supplier	KSA3	MSc	Concrete	10
Client	KSA4	PhD	Construction projects	20
Senior Construction Engineer	KSA5	MSc	University Projects	22
Construction Manager	KSA6	BSc	Contracting	8
Senior Construction Engineer	KSA7	MSc	Consultancy	24

Semi Structured Interview Questions

The interviews were carried around the main research questions. They focused on understanding the current performance measurement in Saudi construction, exploring the factors influencing the projects and the barriers that impact performance measurement. Although these themes guided the interviews, the researcher did not ask exactly the same questions each time. In so doing, each successive interview was used to expand understanding of the subject under research.

Results and Discussion

Current Performance Measurement in the Saudi Construction Sector

The supervisor general of projects (KSA1) stated that there is no proper system in place to measure the performance of the construction projects in Saudi Arabia. Each organisation has its own way of measuring performance, depending on its targets, which, in most cases, are basic measures only applicable to the organisation. The basic measures include schedule over-run and cost over-run, which are used at the project level. Only few well-known organisations in the Kingdom use KPIs. The consultant (KSA2) confirmed that the performance of the projects is currently measured through financial and non-financial measures. These measures include budget, time, return on investment, customer satisfaction and quality of products/services. The client, General Director of University Projects, (KSA4) stated several KPIs used for different University projects (Table 4).

Table 4: KPIs used for University projects

Project cost per unit area (or bed for hospitals...etc)	Ratio of rejected submittals/ total submittals
No. of change (variation) orders during the construction	Ratio of rejected material/total material
Variance between planned and actual progress	Ratio of failed quality test/total tests
No. of professional engineers in the technical team	No. (cost) of items in punch list at hand over
Variance in actual and planned labour (average daily)	Ratio of actual construction time to planned time

The Senior Construction Engineers (SCE), (KSA5) and (KSA7) confirmed the above KPIs shared by KSA4 and advised that weekly progress report is required from the contractor. The report includes the detailed KPIs, which are usually validated through field visits by the SCE. Further discussions on the performance of the project can take place during the weekly meeting between the SCE and the contractor's team. The construction manager (KSA6) working for the contracting company stated that there are three main KPIs to measure construction projects; Cost, time and quality. Detailed cost is tracked through a monthly report containing the planned and actual cost of all items such as material and labour. The time progress is reviewed on a weekly basis during the team meeting. The adherence to quality standards is ensured through regular inspection from the site quality team as well as the consultant team. KSA6 confirmed that the contractor's team shares three different reports with the consultant for performance tracking; daily, weekly and monthly. The daily report includes the completed daily activities, issues encountered and quality/safety incidents. The weekly report includes the actual vs. planned progress (% variance), three weeks ahead planning, sub-metals and long lead items details and site pictures. The monthly report is similar to the weekly one with more details on a monthly level.

Influencing Factors on the Performance of Saudi Construction Projects

According to KSA1, the continuous delay to projects is the main influencing factor on the performance of construction projects in the Kingdom. KSA1 and KSA7 stated that the average time overrun versus the target delivery date is 20%. In some cases, projects can be delivered up to double the target date (100% overrun). This is mainly due to the lack of project planning and scheduling by the contractors, which lead to over commitment to deliver projects within stretched targets. KSA2 identified four main factors that influence the Saudi construction projects; the capability of the assigned construction management to successfully deliver the project within constraints, the proper implementation of construction best practices and standards, prequalification of contractors and the procurement system/contract management. On the other hand, KSA3 emphasised that there are external and internal factors influencing the performance of the construction projects in Saudi Arabia (Table 5).

Table 5: External and internal factors

External factors	Internal factors
Environment: World financial crisis and financial recession and the political instability in the region.	Engineering department: Delay in design face & consultancy.
Client: The payment delay from client and the under –table expenses from client.	HR Department: Non-availability of skilled manpower.
Supplier & sub-contractors: The increase in construction costs and schedule delays.	
Financial Sources: Non ability to access sources of funds.	
Government: Unclear Regulations & rules and under–table expenses.	

KSA4 agreed with KSA3 as well as identifying regulations as another influencing factor on the performance of construction projects in Saudi Arabia. KSA5 stated three main factors that influence the performance of Saudi construction project; Cost, time and quality. Cost and time are owned by the contractor as the price and schedule are shared and agreed prior to the start of the project. On the other hand, quality requires rigorous checks and follow-ups by the SCE to ensure meeting quality standards. According to KSA6, the following factors are influencing the Saudi projects:

1. Delay of shop drawing and approvals from the owner and consultant.
2. Delay of material arrival (procurement delay).
3. Delay of work completion from sub-contractors.
4. Lack of labour.
5. Penalty system is not properly implemented and enforced.
6. Capacity of the contractor companies (bidding on projects more than their capacity).

KSA7 included several other factors such as cash flow issues with contractors, change orders and delays in paying contractors' invoices from the owner.

Challenges that Face the Saudi Construction Sector

KSA3 and KSA4 identified several challenges that face the construction projects/industry in Saudi Arabia. They include:

1. A lack of project management skills.
2. A lack of manpower requirement skill wise, quality wise and volume wise in the market.
3. Conflicts among team members.
4. Project not linked to organisational goals.
5. Lack of clarity in the scope of the project.
6. Project changes not well managed.
7. Training of project sponsors.
8. Loss of control due to lack of detail in project plan.
9. Lack of material and lengthy lead times.
10. Availability of land.

On the other hand, KSA5 stated that continuous delays to projects and project limping are the main challenges facing the Saudi construction projects. There many reasons accounting for these challenges:

1. Lack of quality study to projects initially (inaccurate prices).
2. Unqualified contractors' personnel on the field as well as their management.
3. Changes and modification from the owner.
4. Putting the project for bidding without proper specifications.
5. Delay from the owner in paying invoices to contractors.
6. Increase in materials prices.
7. Change in the environment of the construction site.
8. Emergency cases.

KSA6 and KSA7 stated several challenges facing the Saudi construction industry as follows:

1. Availability of man power.
2. Financial resources.
3. Realistic time for projects completion should be provided by owners.
4. Categories of contractors are not well defined and followed.
5. Delays in decision making (routine work).

Conclusions

The construction industry is one of the major contributors to the Saudi Arabian economy. It is critical to have a performance measurement method in place, in order to identify the gaps and work on actions for improvements. Currently, there is no proper system to measure the performance of construction projects in Saudi Arabia. However, some organisations have their own measures, such as cost and time. Saudi construction performance is influenced by internal and external factors. Availability of qualified personnel, financial resources, as well as the lack of opportunities for real-time control and proper study of project scope, are the main challenges that face the construction sector in Saudi Arabia. In order to obtain accurate results for measuring performance, all parties influencing factors performance have to be measured (i.e. client, contractor, management team, end user...etc). The next step is to use case studies to develop a framework for measuring the performance of Saudi construction projects in order to capture learning and establish recommendations.

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Testing the Justice of English Law on the Builder's Liability in Negligence to a Subsequent Owner of a Defective Building

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Abstract

Buildings may, some time after their sale, become defective due to hidden problems that can only show with time. Under English law, the subsequent owner of a defective building can not claim for compensation from the builder unless there was personal injuries or damage to a property other than the building itself. Unlike the case in other international jurisdictions, which hold the builder liable to the subsequent owner for ten to twenty years, the subsequent owner, under English law, is solely exposed to high risk whereas the builder who negligently created such risk would not be affected by it. This article sets forth the basis for a research that will investigate the justice of this law based on a reasonable and fair allocation of risk between the builder and the subsequent owner.

Keywords

builder's liability, subsequent owner, defective buildings, hidden defects, allocation of risk

1. Introduction

A preliminary investigation of the justice of English law on the builder's liability in negligence to a subsequent owner of a defective building "the law" shows a degree of injustice by not holding the builder liable for making good the defects in the building. This article investigates the justice of the law by studying how the law was founded and developed, the criticism of the law, the international practice, the common concepts of justice underling liability, and finally by evaluating the law based on analyzing its theoretical basis, conducting a comparative law study with international practice, and by assessing the law against different concepts of justice. This investigation comes also as an introductory to the author's PhD thesis to test the "justice" of the existing law.

2. Background

When a building is sold to a new owner, it may suffer some defects in the future due to hidden problems which can not be found during inspection. Examples of these defects are defective foundations, cracked columns, beams or walls, subsiding floors or ceilings, damage to the water or sewer lines, water boilers or electric wiring and the like. Take for example a concrete building designed with isolated footings for a specific soil bearing capacity where the builder was required to investigate the actual soil capacity and adjust the footings accordingly, but he negligently failed to do so and assumed that the soil capacity was adequate. As time passes and the moisture in the soil increases due to rain or irrigation, and as the structure becomes fully loaded, the footings would start to gradually sink in the weakened soil causing subsidence in

the floors, cracks in the walls and in the concrete frame, and eventually rust in the reinforcing steel bars, which would endanger the safety of the building. The repairing cost would then cause a problem to the subsequent owner as explained next.

2.1 The Problem faced by the subsequent owner

Under the sale contract, the seller is not liable to the subsequent owner based on a law called *caveat emptor* meaning 'let the buyer beware', as in the case of *Morley v Attenborough* [1849] 154 E.R. 943.

On the other hand, under the building contract with the first owner, the builder is not liable to the subsequent owner due to another law called *privity of contract* meaning that only a party in a contract can sue on it, as in the case of *Tweddle v Atkinson* [1861] 121 ER 762.

Moreover, under tort law, if the defects did not cause physical injury or damage to properties other than the building itself, then the builder would still not be liable, as in the case of *D & F Estates v. Church Commissioners of England*. Driven by court policy, the tort law on this issue went through significant changes over the last four decades as explained next.

2.2 Development of the law

Before 1972, builders were not held liable under tort to subsequent owners because tort did not include buildings as a court policy at the time, and so remedy was not possible.

Between that there could be a liability in negligence for defective products even in the absence of contractual relationship 1972 and 1983, builders were held liable if found negligent for failure to take reasonable care in preventing defects or if there was an imminent danger to the health or safety of the occupants of the building as in *Dutton v. Bognor Regis UDC* [1972] 1QB 373, *Anns v. Merton LBC* [1978] AC 728, *Batty v. Metropolitan Property Relations Ltd.* [1978] QB 554 and *Junior Books Ltd. v. Veitchi Co. Ltd.* [1983] 1 AC 520).

The law then was based on the *Donohue Principle* established in the case of *Donohue v. Stevenson* [1932] S.L.T. 520 where a manufacturer of a soft drink was held liable to an end consumer who was shocked and became ill upon finding a snail in the drink. In that case it was established based on the view that a manufacturer of goods owes a duty of care to the consumer of those goods if in the absence of such a reasonable care, an injury could occur to the consumer's life or property.

From 1984 until present time, the law shifted its position as to deny remedy to a subsequent owner unless there was physical injury or damage to a property other than the building itself. This shift in the position of the law was based on the decision that, as a matter of policy, it would not be fair, reasonable, and just to hold defendants liable to subsequent owners for any economic loss and that Latent defects in purchased buildings were considered as economic loss based on reduction of quality and hence were not recoverable as decided in the cases of *Governors of the Peabody Donation Fund v. Sir Lindsay Parkinson & Co. Ltd.* [1984] 3 All ER 529, and *Department of the Environment v. Bates* [1990] 2All ER 943.

Having explained the law, it is necessary to explain the causes behind it, why these causes existed in the first place, and the criticism of the law and its causes.

3. Causes of the law

This position of the law was founded on two main principles, the doctrine of privity and the floodgates argument (James, p.74, 306).

The first meant that a subsequent owner could not sue the builder for the cost of making good the defects because there wasn't a contractual relationship between them as in *Tweddle v Atkinson* [1861] 121 ER 762. And the later meant that the courts would not allow action by a subsequent owner against the builder because there would be an indeterminate number of law suits which would expose the builders to a great hardship and would make the courts flooded with law suits as decided in *Victorian Railways Commissioners v Coultas* (1888) 13 App Cas 222, and *Ultramares Corporation v. Touche* (1931) 225 NY 170.

4. Criticism of the law

4.1 Criticism of the Doctrine of Privity

The application of the doctrine of privity was greatly criticized for being inconsistent as it could not provide any solid rule and was therefore considered as “bad law”. (Jacobs, pp. 466-473, Flannigan, pp. 564-593)

Exemptions from the rule of privity were evident of its inconsistency and shortfalls as ascertained in some statutory exceptions (Duxbury, p. 88-90) like:

- a. The Law of Property Act 1925 (s.136) where it is possible to assign rights arising under a contract.
- b. Under the Bills of Exchange Act 1882(s.29) where a third party may sue on a bill of exchange or cheque.
- c. In Married Woman's Property Act 1882 (s.11) where a spouse may obtain the benefit of a contract of life assurance which is made for the benefit of the other spouse.

Such inconsistency and consequential hardship on third parties rendered privity, as described in the literature, one of the most universally disliked and criticized “blots” on the legal landscape. (Dean, pp. 143-152)

Privity was also widely seen as unfair because it did not make any exceptions for situations where the parties to a contract essentially intended for the contract to be benefited and enforceable by a third party.

The criticism encouraged calls for reform that dated as early as 1937, where the Law Revision Committee recommended that the doctrine of privity should be significantly altered.

With the passing of the Contracts (Rights of Third Parties) Act 1999, the doctrine was significantly altered, and it now allows a third party to enforce the terms of a contract if the third party is specifically authorized to do so by the contract or if the contractual terms "purport to confer a benefit" on such third party. Moreover, the reforming Act in addition to removing the “blot” from the landscape, was a desired step to bring the English law into line with the position in Scotland and the majority of states within the European Union as well as other common law jurisdictions in the world such as

America, New Zealand and some Australian states where privity either did not exist or completely abolished. (Dean, pp. 143-152)

4.2 Criticism of the Floodgates Argument

The courts argument, that reversing such policy was feared to endanger the welfare of the defendants and even the courts because so many cases would be raised, was vastly criticised for being unconvincing. This was witnessed in the opposing opinion of Lord Lloyd in the nervous shock case of *Page v. Smith* (No. 2) [1996] 1 W.L.R. 855. It was asserted in that case that the floodgates argument would not necessarily be an obstacle to allow action based on nervous shock as long as the courts are, as ever, careful to recognize a genuine shock resulting in recognized psychiatric illness, and doing so would not lead to any increase in unmeritorious claims.

4.3 Criticism of the position of the law on liability

Criticism of the law was evident in the literature as expressed for example by the opinion of P. Glofcheski, University of Hong Kong – Faculty of Law where he argues that the law which considers damage to the property as economic loss and hence not claimable runs opposite to common sense, fairness, and the expectation of any ordinary person. He further protests that the law is not supported by any economic policy considerations or any defensible legal principles and should be abolished (Glofcheski, p. 206)

Another example of the criticism of the law was given by Robyn Martin, the Modern Law Review where he asserted that the rejection of tortious liability by the House of Lords in *Murphy v Brentwood* could not put an end to the argument on whether or not justice was done in regards to a remedy to the subsequent owner against the negligent builder or local authority, and that several commonwealth courts have refused to follow the Murphy case. (Martin, pp. 94-101)

As seen above, privity, the floodgates and the current position of the law on the builder's liability were not seen by many as the right thing to do which raises the question if this was the same position in the international practice, and if this satisfies the common concepts of justice.

1. Is the law “unjust”?

Before answering this question an attempt was made to investigate the international practice, to examine and critically analyze the law in question itself, and to identify the common theoretical concepts of justice that may underlie the process and outcome of the law making. Such investigations were carried out via the implementation of certain methodologies which are the legal theory research methodology and the comparative law methodology which revealed several facts as discussed next.

5.1 The International Practice

A preliminary investigation of the builder's liability to a subsequent owner in different jurisdictions like Belgium, Denmark, France, Italy, Netherland, Quebec-Canada, Spain and Sweden, revealed that liability ranges from 10 to 15 years from building completion date either under contract or under tort or as a strict liability (which does not need a proof of fault) (Knocke, pp. 109, 140, 174, 189, 225, 266, 316, 233). In nonwestern jurisdictions like in Saudi Arabia and Egypt, the post-construction

liability runs for 10 years pertinent to the building itself regardless of the identity or the order of the owner (Mansour, 85).

Examples of the current international position on the builder's liability are as follows:

- In France, in seeking to protect the interests of building owners and purchasers, France enacted the Spinetta Statute in 1978. In particular, under Articles 1792 and 1792-4-1 of the French Civil Code, builders can be found liable for up to ten years "decennial liability" from acceptance of the construction works when the building suffers from damages of certain gravity, without any requirement to prove fault to claim for the cost of making good the defects. Decennial liability is a matter of public order, which means that it is impossible to exclude it, either contractually between a building owner and the builders, or between these and their insurers. Moreover, decennial liability survives whatever change may affect the ownership of the building, to the benefit of every successive purchaser of the property (Ardis, p.1).
- In Spain, section 1591 of the Civil Code provides that the contractor of a defective building is liable for any damages including also the economic loss within the period of 10 years since the building was concluded. When the builder has failed to fulfill the provisions stated in the contract and the defects arise as a result, this period is extended to 15 years. The jurisprudence of the Spanish Supreme Court has recognized the right of any other subsequent purchasers to sue the contractor, subcontractors and architects under section 1591 of the Spanish Civil Code. (STS 11-12-2003) (14) In this case, the Courts apply the doctrine of subrogation, which means that any person who acquires a property gets automatically the same rights and obligations the seller had (Varea, p.1).
- In Saudi Arabia, the builder's liability in the private and the public construction works is governed by "Public Works Contract 1988 –Article 41-5" where it states that: "The contractor shall guarantee any partial or total damage of what he constructed for ten years from the date of handover if that was a result of construction flaw unless the parties agreed to keep the building for less time.

Contrary to many international jurisdictions, it was found that the current law in England exposes the subsequent owner to high risk where he would solely bear the losses due to defects while the builder who actually created the risk would not be affected by it which in other words brings the builder, under English law, into a more advantageous position upon the transfer of ownership of the building.

Based on the observation that the law in England is not in complete agreement with the international practice, one may also wonder if the law in England, on this issue, is in line with the common concepts of justice, which are examined next.

5.2 The common concepts (or theories) of "justice"

One of the basic aims of a legal system is achieving justice; but one has to first define justice and then determine its relationship with the law (Elliot & Quinn, p.648).

Out of many, the most common philosophers addressing theories and concepts of justice that are identified in the literature on jurisprudence were as follows:

- The Greek Philosopher Aristotle: He thought that a just law is what allows individuals to fulfill themselves in society. He distinguished between distributive

justice by which wealth and honor is distributed among members of the society which is not equally but according to their claim and effort; and corrective justice whereby if the distributive justice was disturbed by wrong doing the judge would restore that justice and would have the damage compensated for (Brooke, p. 25).

- The Natural law theorists: They assume that there is a higher order of law and that justice would be achieved if society would follow this order. This higher order could be discovered from nature like Aristotle also thought. And that natural justice implies the existence of a moral principle of self evident and unarguable truth. Amongst the naturalists, Medieval Scholar St. Thomas Aquinas who thought that the higher law was derived from God and that a law could be unjust if it is contrary to human good in form or result. By this concept justice dictates that people must be treated equally with out prejudice or interest (and this impartiality is what marks the procedural law in England) (Hart, p, 206, Jackson, p.1).
- The Utilitarians: They think that justice is based on maximizing happiness for the majority of the members in a society even if some individual lose out, and that laws are assessed as just by their desirable consequences. (Bix, p. 126)
- The Economic analysts: These philosophers believe that a thing has value for a person when that person values it and that value can be measured by how much that person is willing to pay for it or give it up. For example in a public hospital if ten minor surgeries for ten people equate to the cost of one major life saving operation to one individual, then justice would give priority to the ten operations which would produce greater benefit for more number of people for the same cost which is a better way to spend public money regardless of what happens to the first patient (Elliot & Quinn, pp. 649).
- John Rawls: In his book 'A theory of justice' Rawls defined justice on the basis of his concept of 'The Veil of Ignorance'; he asserted that in order for the law to be just those who make the law must wear a veil of ignorance before they decide what the law should be which meant that they must not know how and what parties including themselves would be affected by the law. This concept would make the law, when made by any party, dependant on pure reason only and not affected by any external influence; and hence any party would reach the same conclusion on what the law should be (Rawls, p. 118).
- Nozick and the minimal state: He believes that the state should have minimum right to interfere in the affairs of the individuals and must limit its function to basic needs like protection of the individuals against crime and enforcing contracts (Elliot & Quinn, pp. 650).
- Kelsen and the positivists: They believe that it is not possible to define justice because it is an expression of individual preference and values and hence irrational ideal. Therefore, law can be separated from justice and morality; and that the law may partly be based on morality and justice though that is not an essential part of it, and that the law must be obeyed regardless of what is just and moral (Coleman and Shapiro, p.9).

Based on the preliminary investigation of the legal issues pertinent to the problem, the exploration of international practice, and the identification of the common concepts of justice, the analysis of this issue is carried out next.

2. Analyzing the problem

- Since the 'Contracts (Rights of Third Parties) Act 1999' presumably represented the just thing to do for a third party, and since the Act was theoretically applicable

to the subsequent owner of a defective building, as a third party, which meant that remedy should be approved under contract, and since the natural role of the courts was to do justice, and since the courts chose not to apply the Act to buildings, as it did for decades, but instead continued as a matter of policy to apply the doctrine of privity (that was deemed unjust by the Act) which seemed to be driven by the floodgates argument again as in tortious situations, then it could be said that justice as seen by the Act was not done due to court policy.

“Policy as an argument is defined as substantive justifications to which judges appeal when the standards and rules of the legal system do not provide a clear resolution of a dispute” (Bell, p. 22). However, “Policy need not be invoked when reason and good sense will at once point the way” (*Dorset Yacht Co Ltd. v Home Office*).

- On the other hand, and as explained above, since the law on the builder's liability under tort was incrementally developed over more than four decades through case law that satisfied the legal concepts over which it was founded, and since these concepts had a lot of flaws and were the subject of serious criticism of many authoritative legal figures for being unfair, and since the position of the courts on liability under tort was inconsistent and contradictory over that period, and since the law was eventually settled to be congruent with the general court policies, as the right thing to do, and due to the criticism of the law itself on liability for being unfair, then it could be said that the position of the law was actually meant to satisfy court policy rather than to satisfy justice. Policy, hence, seemed to technically operate as a protective shield for justifying the position of the courts on liability under contract and under tort which rendered the role of the court in doing justice in this regard appears to be a matter of contradiction.
- To further explore this contradiction, if one considers the current position of the law in regards to remedy by the builder for defective buildings, one could see that such remedy would be granted to the first owner under contract but not to a successive owner for the same defects occurring at the same time due to the absence of a contractual relationship. And when the time allowed by the law to sue under contract lapses, the first owner would still have the right to sue under tort while the successive owner would not be able to do so for the same defects occurring at the same time for the assumption that defects are deemed as a reduction in quality in the purchase and hence the loss was deemed as economic loss which is unrecoverable under tort.

This meant that the law changes position, under both contract and tort, according to the change of the identity of the owner for the same building, for the same defects and for the same time of occurrence. Accordingly, this meant that there was a contradiction either in the concept of justice underlying the law or in its application in this regard. This contradiction resulted from the fact that justice was not an independent concept but was rather something dependent on the identity of the plaintiff.

- It may not be easy to notice this contradiction and hence accept the possibility of the injustice from within the English legal system itself, but one could see such contradiction by comparison with the position of the law on liability in different international jurisdictions as shown above.

Therefore, it may be argued that if the law was not in line with so many jurisdictions and if the law was based on principles that are unconvincing, criticised and often described as unjust, then there may actually be a degree of injustice in the law that needed to be examined and verified, and that if the injustice was proven then the law on liability should be reformed.

- And since it would not be reasonable and sufficient to describe a legal system as unjust because of the presence of opposing views or because it was not in line with another, it was necessary to find a convincing measuring criterion to verify the justice of the law.

Therefore, a definition of justice outside the arena of the court was sought within the common concepts (or theories) of justice in order to evaluate the justice in the contemplation of the court itself.

The latest and most popular and prevailing concept of justice out of the concepts explained above was found to be that of 'The Veil of Ignorance' in the book of 'A Theory of Justice' by John Rawls (Rawls, p.118).

This concept of justice was chosen for its abstract nature as the prime criterion to weigh and test the current concept of justice, expressed by the courts decisions, which harbored the principles and policies underlying the current position of the law on the builder's liability.

This philosophy of justice as the prime criterion was then applied to weigh and test the current concept of justice of the court in regards to the law on the builder's liability. It was evident that the law, based on policy, was designed and occasionally tailored to provide convenience for the courts and protection for the builders. On the other hand, this policy, as an external factor, resulted in hardship and financial losses to the subsequent owner of the defective building.

Therefore, in this case, one can say that the making of the law was affected and was actually shaped by external factors (policies, courts, and defendants) and hence 'justice as defined by Rawls was not done' which greatly suggested that the law in this theoretical perspective was unjust.

3. Conclusion

According to this initial study it may be concluded that in order for the law to be just, a sufficient and adequate protection must be provided for the subsequent owner. This suggests that the liability of the builder should be extended to include any subsequent owner of a defective building either under contract or under tort, and the question then becomes how and for how long.

In answering such a question, the laws of other jurisdictions that could satisfy the same authoritative definition of justice, or even a new concept developed as a model for this purpose, may be benefited from in deriving an equitable and just solution that is suitable to the problem of the builder's liability under English law. This is being carried out at present time by the author for his PhD thesis at the University of Salford, UK.

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Why are Property Boundary Disputes increasing in Ireland?

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Abstract

Recent anecdotal evidence has shown that property boundary disputes have been on the increase over the past number of years (Prendergast 2008 and 2011). This paper will highlight results from a questionnaire to Irish property professionals in an effort to understand what they have been dealing with over the past number of years, including the impact of the PRAi Digital Mapping Project on their work, the most common type of dispute they deal with, the length of time they devote to property boundary disputes in the past 10 years and the number of Boundary Surveys conducted between 2007 – 2011.

Keywords

Boundary Surveying. Ireland. Property Boundary Disputes. Property Professionals

1. Introduction

Boundary disputes have caused countries to be divided, towns to be split up and neighbours to fall out. People value land for spiritual, social, & economic reasons, it is not just something people walk on. Irish society for instance, has had a long affection with land and boundary disputes have been famously depicted in literature and film. This connection to land has been highlighted by Patrick Kavanagh in his 1938 poem, "Epic", which described a violent row between neighbours. More recently the 1990 Hollywood movie, "The Field" which written by John B. King, featuring "The Bull McCabe" who did all he could to save (murdering the purchaser) the land he loved from being sold at public auction. These issues continue to be applicable in modern Irish life and have not lost relevance where one witnesses numerous land and boundary disputes cases in the courtrooms of modern Ireland.

This research has focused on these property boundary disputes that have caused much strife in Irish society. The aim of this research is to attempt to capture the number of disputes occurring in Ireland during the past number of years and the reasons behind their frequency. Throughout the recent past, property boundary disputes have seen to be quite prevalent within the Irish High Court with eighteen reported cases. They have indeed kept Land Surveyors, Engineer, Architects and other property professionals busy on the ground with a number of issues continuing to appear.

2. Days Worked on Property Boundary Disputes

Participation for this research was from property professionals located within Ireland. Emails to the relevant professional bodies were sent in an effort to obtain the most experienced professionals to complete this survey and assist with this research. The number of respondents represents only a small portion of the work being carried out in relation to property boundary disputes.

Table 1: Number of Respondents

Professional Body	Membership Numbers
Irish Institute of Surveyors	375
Society of Chartered Surveyors Ireland (Linkedin members)	806
Engineers Ireland (Civil Division)	400
Royal Institute of Architects of Ireland	2,415
Law Society's Conveyancing Committee	22
Total Emailed	4,018
<i>Total Number of Respondents</i>	125 (3.1% response rate)

With the increasing numbers of court cases in Ireland today, one of the aims of this research was to identify the number of High Court case law judgements within the past number of years. In addition, this survey required professionals to supply the number of days of their total workload that related to disputes over property boundaries for the past ten years. Data required was for legal disputes (not boundary problems which were resolved without surveys or litigation) where parties engaged property professionals. Respondents were also required to omit boundary surveys for transfer of property.

The days inclusive from 01/01/2002 - 01/01/2012 were calculated. During this period of 3,653 days, there were 81 public holidays, and 1,044 weekend days, leaving a total of 2,528 working days. Personal holiday dates were not accounted for. Of the property professionals who completed the survey, a total of 1,136 days were devoted solely on boundary disputes.

With 1,136 days of boundary dispute work professionals undertook in the past ten years, 1,447 boundary surveys were conducted as part of a dispute in the past five years of those professionals surveyed (see Section 5). This would indicate that there were more boundary surveys as part of dispute in the past five years than the days professionals worked in the past ten years.

3. Most Common Type of Dispute

In an effort to discover what category of dispute the professionals dealt with most frequently in relation to their workload, different categories of disputes were investigated, Inaccurate Measurement/Mapping Dispute, Property Boundary Dispute, Right of Way, Encroachment, Adverse Possession and other. These category choices were chosen because of the level of frequency they occurred within the Irish court reports and also because of their historical significance within Irish culture. Certain professionals may see a certain scenario as a boundary dispute, such as when one acquires title to land or property by occupying it for a period of time, however in fact this is known as Adverse Possession. Also, many people may see a legal right of

passage over another persons land that comes into conflict as a Right of Way, however this is not a property boundary dispute and as such a distinction needed to be made. These are however vital components to all matters relating to land law and disputes over land, however not necessarily a property boundary dispute upon which this research is concerned. There was also a need to differentiate between Property Boundary Disputes and Inaccurate Measurement/Mapping Disputes. Mapping disputes needed to be singled out on its own because this was identified to be a key factor in creating issues over property boundaries in previous questionnaires designed for this research. Of the options given, the most frequent categories are ranked and described below. 3.1 Inaccurate Measurement/Mapping Dispute

Inaccurate Measurement/Mapping Dispute was the most common choice among the professionals as to the types of dispute they deal with most frequently. The Land Registry in 2005 announced that all existing paper based maps would be converted into electronic form over a five-year period, known as the Digital Mapping Project (Prendergast, 2011). In August 2010, the mapping project was completed with all 26 counties fully digitized. The digital mapping project now provides easy access to data, which is viewed by clicking the seed point on the map to give information on the property, including the folio number and details of the folio. However, these newly digitized property boundaries are not quite the same as old paper maps and one of the impacts is that landowners cannot take new digitized PRA boundaries at face value as they must be checked on the ground by a qualified and competent surveyor to verify their position (Prendergast, 2008).

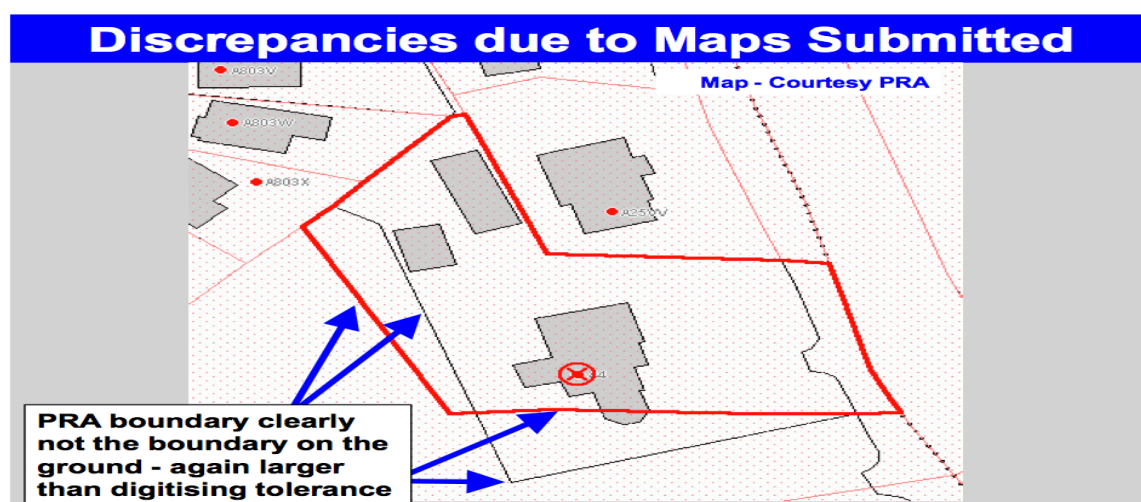


Fig. 1. Example of the new digital mapping discrepancies (Prendergast, 2008)

3.2 Property Boundary Dispute

Disputes over property boundaries were the second most frequent type of dispute encountered by property professionals. Boundary disputes between neighbours can be wretched affairs known to destroy neighbour relations where the financial cost of litigation frequently exceeds the value of the land concerned. In some cases the area of land in dispute will be very small but litigation may ensue because of its critical location or its strategic importance to the owners concerned. In some other cases the dispute may become a proxy for another issue dispute because the land concerned may not be worth much at all. The two categories of Inaccurate

Measurement/Mapping Dispute and property boundary disputes accounted for eighteen reported High Court cases from 2000 - 2011.

Encroachment (3rd), Right of Way (4th) and Adverse Possession (5th) were the other most popular choices of dispute category professionals dealt with.

4. Impact of Digital Mapping Project from 2003 - 2011

The question posed, how many requests/recommendations for property boundary surveys arising from boundary disputes did you encounter from 2003 - 2011?

Through previous research surveys, the most common problem and area of concern identified by landowners was that of the new PRAi digitized mapping where the digital property boundaries did not match the property boundaries on the ground. Thus by asking professionals the estimated numbers of disputes they encountered in 2003, 2005, 2007, 2009 and 2011, it would highlight if there was an increase in disputes and if this increase correlated to the provision of digital mapping by the PRAi. That is not to say that all the disputes were digital mapping PRAi related, however, it cannot be just a coincidence if in fact disputes rose significantly during this period from 2007 - 2011 when the newly digital mapping was released by the PRAi between 2006 and 2010.

Table 2: Year and Number of boundary surveys recommended between 2003 - 2011

Year/ No. of Surveys	1-2 (x 1.5)	2-3 (x 2.5)	3-4 (x 3.5)	4-5 (x 3.5)	> 10 (x10)	Total
2003	23 (34.5)	14 (35)	5 (17.5)	4 (18)	3 (30+)	49+ (135+)
2005	26 (39)	12 (30)	8 (28)	2 (9)	4 (40+)	52+ (146+)
2007	23 (34.5)	15 (37.5)	11 (38.5)	5 (22.5)	4 (40+)	58+ (173+)
2009	24 (36)	14 (35)	9 (31.5)	6 (27)	5 (50+)	58+ (179+)
2011	24 (36)	15 (37.5)	8 (28)	6 (27)	7 (70+)	60+ (198+)

The level of requests/recommendations for property boundary surveys arising from boundary disputes is strikingly high in 2011. If in 2011 the seven respondents who conducted more than ten surveys in that calendar year, then one could estimate that over seventy requests/recommendations for property boundary surveys arising from boundary disputes occurred in 2011. The increase in these requests/recommendations for property boundary surveys arising from boundary disputes could be from a number of reasons.

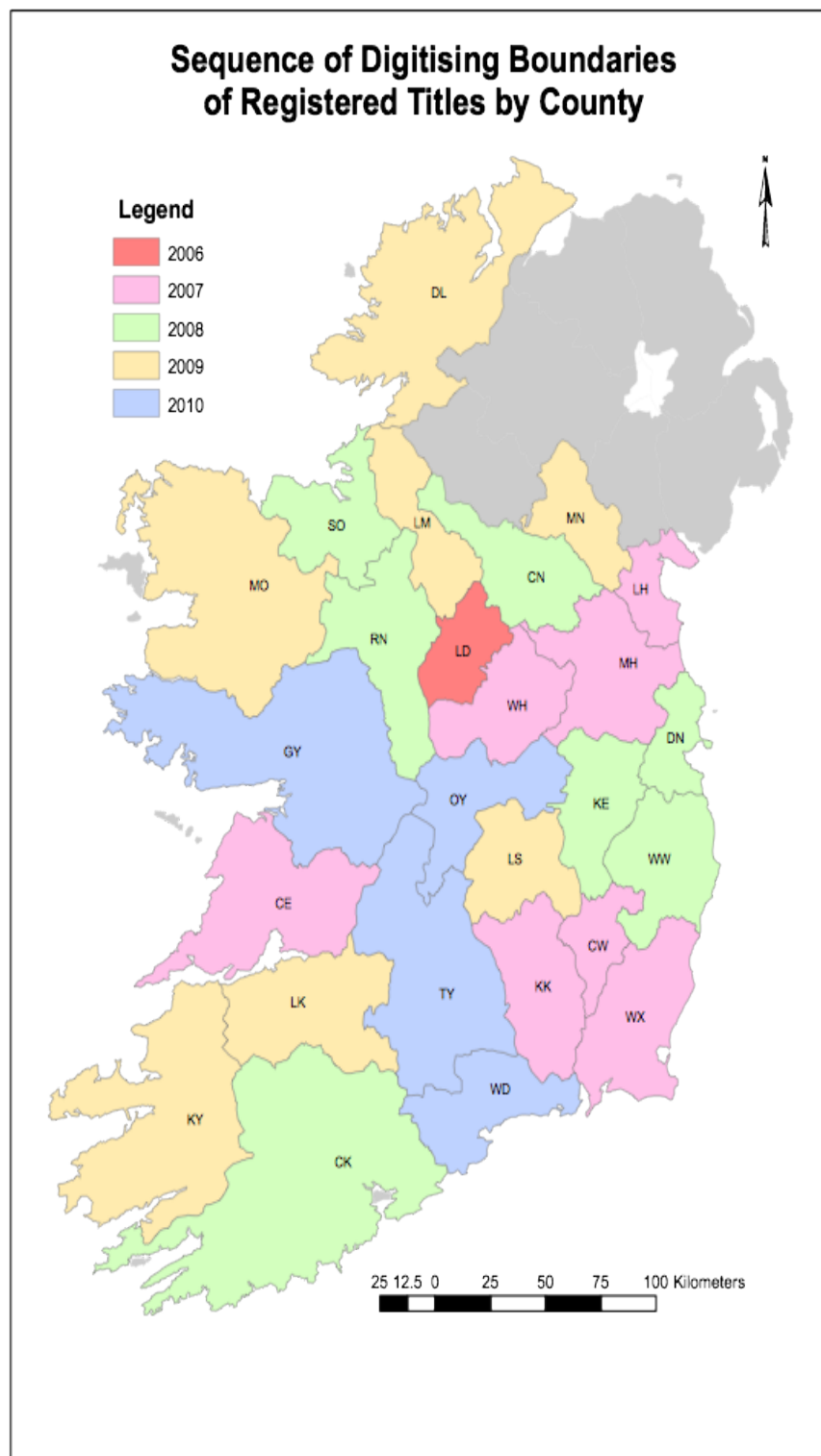


Fig. 2. Counties digitized from 2006 - 2010 (Prendergast, 2011)

4.1 Digital Mapping Project

The table (Table 2) suggests that when the digital mapping project was introduced in 2005 an estimated number of boundary surveys recommended as part of disputes was over 146 and these numbers have increased steadily by 2011 with over 198 disputes. That is a 36% increase from when the digital mapping project was introduced in 2005 to its conclusion in 2011.

From all the good work the PRA have done in the past number of years seems to feel inadequate if the numbers are gradually rising from 2003 before it began, to 2005 when it started, to when the digitizing of property boundaries was completed in 2011. The digital mapping project claims to define property boundary parcels for every land parcel in the country, yet the land registry claim no responsibility and are not in a position to advise if an issue or a problem arises because of their work, "I have a dispute with my neighbour over where the boundary lies. Can you tell me who is right? No. The Land Registry map is an index map and identifies property, not boundaries. Therefore, we are not in a position to advise" (PRA, 2010).

A great number of professionals claim that their work to date is full of disputes that correlate to inaccurate digitizing property boundaries, which, do not correspond with the parcels boundaries on the ground. In 2003, three respondents had more than ten disputes, i.e. estimated to be more than thirty, before any digital mapping project was initiated. In the intervening years there seems to be a steady increase in the amount of disputes taking place. Is this a coincidence? This research attempted to knock out the suggestion that this is just an assumption based on a few research questionnaires. The level of disputes need to be examined thoroughly and especially so for the landowners who spend their money on needless disputes that could easily be fixed by having a property boundary system that accurately defined property boundaries.

The increase in disputes in the recent years is a stark reminder that the digital mapping project did nothing to curtail disputes. It many have improved the cartographic quality of their index maps and the use of GPS compatible ITM coordinate reference system (Prendergast, 2011), however it does not have seem to have dealt with an underlining problem with the quality of mapping and it seems to be giving rise to more and more of them rather than reducing them.

4.2 Land Value and Economic Impact

With disputes and boundary surveys seemingly on the rise, another suggestion as to why this is so, would be to assess if the land values and property values over the past number of years have had an influence. Land in Ireland has always been sacred. Over the past decade, Ireland's farmland market has witnessed an extensive change with soaring average land values in 2006 where the average value was €26,000 per acre, followed by the recession and drop in prices of 56.8% in 2010 where the average price per acre was €8,741 (Savills, 2011). Property Values have seen a similar trend. Ireland experienced one of Europe's biggest property booms in 2007, to become the world's biggest property crash in 2008 when the property bubble inevitable crashed. From its peak in 2007, the national average property price was €366,000, compared to the most recent valuation of properties, the average property price was €177,000 in 2012 (Global Property Guide, 2012).

With property values being at such a reduced rate in 2012, purchasers of property are taking no chances when it comes to buying property. Boundary surveys of the property and full due diligence are now essential when buying distressed property (Morgan, 2012). Could the correlation in the reduction of property and land value over the past ten years be a key factor in the increase of property boundary surveys and disputes?

4.3 Increase in Litigation

As this research has shown there have been eighteen reported High Court cases from 2000 - 2011. From 2000 - 2003, there were four reported property boundary dispute cases, with fourteen property boundary dispute cases from 2007 - 2011. This was a stark increase in the reported court judgements from 2007 - 2011, Irelands recessionary years. According to Harris (2012), litigation in Ireland has been busier than ever and stem from the underlying factor of the financial recession where commercial litigation is rising. Kirwan (2011) Solicitors in the UK have seen the number of neighbours disputes over boundaries during the recession period rising because of the financial pressures people have and thus want to take action on their neighbours. Landowners are very passionate and protective of their property and what they perceive to be their land. If one then adds in other external factors such as stress at work or financial trouble, one then has a potent cocktail for a property boundary dispute with the most prominent dispute often being over some seemingly minor issue such as a fence being erected or a hedge being planted on the boundary line (Kirwan, 2011). Could the significant rise in litigation be correlated to the gradual rise in the amount of boundary survey requests/recommendations during this period? Or are people are becoming more litigious in recessions over boundary disputes?

5. Boundary Surveys conducted from conducted 2007-2011 as part of disputes

This research and other research conducted by the Irish Institute of Surveyors (IIS) and the Inter-Professionals Task-Force on Property Boundaries (IPTFPB), has shown that there is growing anecdotal evidence of a significant increase in the numbers of boundary disputes in Ireland during the past decade. In Europe and in particular Denmark, where the land area is smaller and has a slightly larger population than Ireland, it has had an average of forty boundary dispute cases per year in all courts during the 1990s (Enemark, 2005). This could be because of their Cadastre system and or the role of professional Land-inspectors who conduct the boundary surveys on behalf of the state. In contrast, IIS research has identified one survey company in Dublin that had eighty-seven boundary survey requests arising from disputes in the first eleven months in 2007 (Prendergast, 2008). The IPTFPB identified that 87% of professionals had boundary disputes because of the mapping issues (Prendergast, 2011). This evidence and others suggests that the incidence of boundary disputes in Ireland is significantly more than the international norm and there is a need to confirm if this is correct and if so, the reasons why it is.

The vast majority of work carried out on a daily basis by Land Surveyors, Engineers, Architects is executed without any sign of conflict or dispute attached to their work. However when such occurrences happen they need to be armed and ready to defend their work. In an effort to confirm these figures over the past five years respondents were asked a) how many boundary survey were conducted/recommended as part of a dispute and did not proceed any further and b) how many boundary surveys were conducted/recommended and proceeded for mediation/litigation. Five years was the chosen timeframe as there were fourteen cases in the High court reported from 2007 - 2011. The property professionals who participated were Land Surveyors, Engineers, Architects, Legal Professionals and other land professionals including a GIS specialist and an Urban Planner. An estimated 1,447 boundary surveys were carried out from 2007 – 2011 as part of a property boundary dispute that was resolved and did not go any further once the survey was completed. A further 252 boundary surveys were conducted as part of a property boundary dispute that went to an official dispute

resolution service, either litigation or mediation. From 2007 - 2010, there was a slow and steady increase in the amount of boundary surveys as part of disputes. There was however a significant jump in the number of boundary surveys as part of disputes from 2010 - 2011, a 31% increase in one calendar year.

Table 3: Boundary Surveys as part of Property Boundary Disputes 2007 – 2011

Year	Boundary Survey complete and dispute resolved on site	Boundary Survey conducted as part of litigation/mediation	Total Boundary Surveys
2007	264	51	315
2008	271	42	313
2009	277	47	324
2010	275	49	324
2011	360	63	423
Total	1447	252	1699

These numbers seem quite high, as do the number of surveys as part of a dispute that went to litigation/mediation, especially in 2011. As this research has established, the number of reported boundary disputes cases in court has been seen to be quite low, eighteen in the past number of years. This survey was hoping to further elaborate on this data and see if it was similar to those being reported in the courts. As the results show, there has been far more activity outside the courts to resolve potential disputes without litigation. The above numbers are extraordinarily high and are not in proportion to those disputes being reported in court.

Fourteen property boundary dispute cases have been reported from the High Court compared to the 252 encountered by property professionals from 2007 - 2011. In effect, 238 property boundary disputes were not reported. This could be mainly because of two reasons, i) that some of the cases that proceeded to mediation were not be reported and not public knowledge because this process is private or ii) that a portion of these cases that went to litigation would have been a result of a case that was of a similar nature previously occurred in the courts i.e. precedent, which indicates that 6% of the cases are reported, thereby raising new issues and creating new precedent/common law. Interviews with a number of respondents will be conducted shortly to examine the frequency of litigation/mediation and whether property professionals use case law/precedent to advise their clients. There is a stark increase in the number of disputes that went to litigation/mediation from 2010 - 2011. Can this be explained?

6. Conclusions/Recommendations

The number of boundary surveys recommendations/requested as part of a dispute from 2003 - 2011 has increased by 47%, the number of boundary surveys conducted and resolved the dispute on site increased 36% from 2007 - 2011 and the number of boundary surveys as part of boundary disputes that went to litigation/mediation, have soared from 2007 - 2011 by 34%. These figures highlight the dramatic increase in

number of boundary surveys conducted in the past number of years. Sections 4 and 5 have made suggestions as to maybe why these numbers are exceptionally high, such as the impact of the digital mapping project and the economic impact of land and property prices. However, other reasons such as difficult neighbours, the use of new surveying technology being continuously updated and used or even the access landowners now possess to the PRAi digital mapping and thus are able to identify discrepancies more easily than before, could also be a factor to these high numbers.

This research has shown that the level of disputes in the past number of years has been on the increase and that the cases being reported within the Irish High Court are only a small portion of all the disputes i.e. 252 Boundary Survey conducted as part of litigation/mediation vs 14 Reported High Court Cases in the same five years (6% reported). As stated this could be from a number of reasons, including, some cases proceeded to mediation where these are not reported to the public as this is a private process or in fact that a portion of these cases that went to litigation may have been a result of a case that was of a similar nature previously occurred in the courts i.e. precedent. With the high number of boundary surveys as part of disputes in the past five years and the gradual increase in boundary surveys as part of disputes in the intervening years of the digital mapping project, ways in which to minimize disputes need to be made. There have been suggestions and calls for a cadastre like system to be implemented where all property parcels would be conclusive and guaranteed by state however with current economic climate, this approach seems unlikely. One ideal and cost effective way to minimise disputes would be to improve landowners and property professional's knowledge on the problems that are currently on going with boundary disputes.

This research has previously noted how case law could be an influential factor in minimizing disputes over the next coming years in the form of a 'Guidebook' and with this paper highlighting the compelling data of how many disputes are currently going on in Ireland, this seems like an opportune time to implement one incremental change of reform. The 'Guidebook' would examine previous case law and detail the cases in the case briefing manner. The reasoning behind making case law a fundamental criteria for surveyors to acknowledge and understand in disputes is highlighted by the high volume of boundary surveys and the number of disputes that are heard in the High Courts of Ireland. With the reported eighteen High Court judgements in the past ten years specifically on property boundary disputes, each one offers a different and novel solution for these most avant-garde issues. With this in mind, it is anticipated that this 'Guidebook' will help assist and benefit how property boundary disputes are resolved in the future.

In addition, assistance and support will be required from the professional bodies who will be required to generate the awareness needed for the 'Guidebook' to be implemented into practice. This survey also highlighted the most effective way of resolving disputes with Neighbour Negotiation deemed the most appropriate choice in resolving disputes. Further detailed data is needed to show how and why ethical standards and a Code of Practice for surveyors is required as of the level of disputes that have taken place over the past number of years within the category of inaccurate mapping/measurement disputes is notably high.

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Assessment of Construction Site Manager Skills and Knowledge Needs in Iraqi Construction Firms

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Abstract

Recognition that training is the most appropriate action for improving the performance and efficiency of construction site manager which is agreed by practitioners, academics, government agencies, professional institutions and clients of the construction industry. Construction employees need to be kept abreast of the challenges of ever-changing construction technology, knowledge ideology, management techniques, dynamic nature of construction site works and this requires training and retraining. Such a concern stems from the realisation that the industry must endeavour to provide a truly professional service or product which is qualitatively superior and gives value for money. The aim of the research is concerned with finding an appropriate body of skills and knowledge, based on what "Project leader engineers and Site managers do perceived the importance of skills and knowledge for the future in Iraqi construction industry and identify site manager priority for training need as perceived by them. These findings will become significant in determining the composition of site manager training courses. The investigation was carried out by means of survey questionnaires and a case study to ascertain the need of site manager's training in Iraq and to identify the areas of importance of skills and knowledge of site managers. The presented data was driven from a study of 80 site managers in Iraq.

Keywords

Training needs assessment; TNA; site manager skills knowledge needs; Iraqi Construction industry

Introduction

Report by USAID (2006) said that building and construction in Iraq picked up considerably after 2003 resulting in nearly 4.8 % cent of total Gross Domestic Product (GDP). This growth is believed to be as a result of the implementation of capital and free market with international support to Iraq. Additionally, there were observed increases in housing projects both by the governments and the private property speculators. The inter-sectorial impact on the construction industry has been tremendous leading to upward swing in the reported contribution of the industry to the GDP. The prospect of inflow of more foreign capital is bright with the government's effort at promoting public private partnership especially in power generation and other infrastructures. The construction sector is one of the most dynamic sectors in the Iraq economy, with upstream and downstream economic links. The sector has been growing rapidly since the 2003. Upstream economic links include industries such as tourism, energy, oil, *etc.* These industries require the services of the construction industry for the execution of infrastructure projects such as roads, airports and ports.

On the other hand, downstream links include industries such as building materials, cement and steel, which have seen a rise in the demand for their output in line with the expansion of building and construction activities. The contribution of the construction industry to Iraqi GDP has almost more than doubled from since 2003 represented 4.8% of the GDP while in 2000 was represented only 0.2 of the GDP (PADCO, 2006; USAID, 2006).

The progressive changes and the effect of the competitive market felt by the Iraq construction industry since 2003 have enhanced the need for superior skills in the construction industry. However the industry often faces many challenges, such as the shortage of skilled workers that often lead to cost and time overruns and quality shortfalls. Construction industry in Iraq is largely low technology; low skill and labour intensive, and there is now clearly an urgent need for training in Iraq construction firms (Alshaw & Alkinani, 2011; USAID, 2006; Khairuddin, 1995). The areas of skills required for specific training need to be identified in order to keep the construction workforces abreast with new developments in the construction industry .Therefore, it can be said that training needs is likely to play a major role in the development of workforce skills in construction industry (Teixeira, et al 2006; UN-HABITAT (2007).

Chan (2002) said that due to changes in technology, knowledge ideology, management techniques, government etc and this entail a lot of training must apply to construction companies in order to be able to cope with the vitality of the world in construction industry. The capability of the construction industry to develop, procure and deliver innovative, complex and demanding projects, is driven by involvement of highly knowledgeable and skilled workforces especially these who work in managerial level . The on-going skills crisis in the construction industry, particularly at the management level, has resulted in the urgent need for more training in construction project management, and this has consequently become an important issue in the construction industry (Odusami et al, 2007). Training has long been identified and recognised as one of the fundamental and key processes within the construction industry to assist organisations and meet the need of workforces with these qualities (Hassan et al, 2004).

Training has long been identified and recognised as one of the fundamental and key processes within the construction industry to assist organisations and help them to meet the needs of its workforces (Odusami et.al, 2007). Training lies at the core of creating, maintaining and developing the construction workforce, who contribute significantly to the achievement of the construction project's objectives (Teixeira and Pires, 2006; Odusami et.al, 2007). The lack of skilled and knowledge among construction managers has a negative impact on contractors and owners due to delays in time schedule and rework of tasks. Construction industry requires a multiple skills form construction workforce to finish the task with specific skills. (Marzouk, 2009).There is a general belief that construction organisations are being faced with skill shortages of managers. How they have been coping with the dynamism of the changing world of construction technology, material innovations, management techniques, and knowledge profusion and client requirements remains a subject of continuous inquiry (Odusami et.al, 2007). Construction researchers have been investigated more into training needs of workforces particularly site managers (Odusami et.al, 2007; Adams, 1992 ;Waha , 1991) Odusami(et al ,2007) as well as Teixeira et al (2006) dealt with the training of project managers. It is necessary to

observe that there is a general lack of research information generates the need of establishing training needs of site managers on individual level, within the Iraqi local construction climate. It is relevant to inquire into the subject areas where the Iraqi construction site managers are experiencing shortages of skills and knowledge, what training philosophy they support and what training methods and modes they prefer.

2. Literature review

2.1 Training Needs Assessment (TNA)

Empirical researchers studied have confirmed that conducting needs assessment is a crucial subject in training programme that leads to the successful outcome of any training programme. Brown (2002) emphasis that developing and implementing training without conducting needs assessment might lead to the risk of failing of training , or missing the aim of the assessment entirely . Brown (2002) identified four reasons for carrying out a needs analysis before training. These are:

- To identify specific problem areas in the organisation
- To obtain management support
- To develop data for evaluation
- To determine the costs and benefits of training

Marzouk, (2009) said that a needs assessment is used as a tool that identifies training needs and evaluates the effectiveness of training programmes that currently exist or have the potential to exist in the future. According to Brown (2002) training needs examines on three levels such as: organisational, task and individual. Organisational analysis concentrated on departments that need training. This is implemented while paying attention to the changes that might take place in the future such as a change in skills needs the labour pool, and/or laws and legislations. Task analysis focus on job requirements and matches employees' skills in organisation to identify the jobs that have to be achieved, conditions of performance, and which skills and knowledge required to finished the task, and where and how these skills are best acquired. Individual analysis focus on how well individual perform their jobs (Marzouk, 2009).

2.2 Training Needs Methods

There is a distinction between methods and techniques used to identify training needs. Even though some authors (Goldstein and Ford, 2002) used both terms to refer to the same things, this study differentiates between method and techniques in identifying TNA. Jamil (2006) defined methods as *"the instruments that analysts can use to collect data for TNA purposes and they include methods such as questionnaires, interviews, group discussion methods, observation, etc"*. He also defined techniques *"as the procedures to which TNA can be conducted and the analysts may need to adopt some of TNA methods to carry out the techniques"*. This was confirmed in the work of Ogunlana, et al (2002) where they examined a number of training needs methods for different categories of construction firms by making comparison which one is best, and they came out with conclusion that there is no method that can be identified as the best method. In fact, it is not a question of 'either/or' but of which method is appropriate for a particular purpose, at a specific time, and in certain circumstances. Table 2 outlines different training needs methods that can be used

generally and some of these methods can be applied in the case of construction site managers.

Table 1 : Training Needs Assessment Mothers

Methods	Explanation
1-Delphi Method	Delphi is a group discussion method which allows communication between participants who are distanced from each other. Basically, the method is based on an understanding of the concept of group dynamics. Firstly, it is recognised that each participant does not have the same information. This generates the need to make decisions as a group group in order to produce better decisions. Secondly, some members may not have been encouraged to offer their opinions and may feel uncomfortable in doing so, especially to those members of the group in higher level positions. In order to address these needs the Delphi method was created. The use of Delphi in TNA is recommended as one of the tools to analyse training needs.
2- Questionnaires	Questionnaires are the most widely used method of data gathering for needs assessment. They are the most economical as they can be quickly distributed among a large group and are also relatively simple to administer, straightforward and easy to analyse.
3-On-site Observations	On-site observations methods are used to distinguish between effective and ineffective behaviour and organizational structures and processes. They are also a common way of conducting job analyses. Observations must be carried out by subject-matter experts (SMEs) if the data they yield is to be useful. One criterion for selecting SMEs is that they need to be experienced and knowledgeable about the job they observe (Jamil, 2006). Brief educational visit lasting a day or at most two to provide freehand information of objects and people being studied which would never occur in classrooms or conference rooms, to summarize and consolidate initially presented by some traditional methods as well as to provide new information This method is only useful if the job is observable and measurable and can be analysed in terms of which SKAs are required to perform the job effectively.
4-Advisory Committee	This is another form of group decision creating technique which involves employees at different levels in organizations who have information regarding an issue. The advantages of this method are that it builds management involvement and sponsorship in the TNA process, it is inexpensive to carry out and it involves key decision makers, thus making the task of implementing the results easier (McCoy, 1993). However, this method is time consuming, and it is sometimes difficult to organize meetings involving all the members, as there is a tendency towards 'groupthink' syndrome in the group decision making.
5-Document Reviews / Examinations	As stated earlier, there are many readily available documents which can provide data for TNA exercises. Examples of these include those that give information on employees' productivity, absence rate, organizational charts etc. The advantages of the available data are

	<p>that they can provide objective evidence regarding performance problems and analysts do not have to spend too many resources in gathering them. However, existing data must be treated with caution. They tend to be incomplete and do not show the background and causes of the problems, are usually quite old, and skilled data analysts are needed in order to examine and make sense of the data in the context of TNA.</p>
6-Focus Groups	<p>This method involves small groups discussing issues or problems to produce new ideas, solutions, and proposals. The use of focus groups has become popular in the marketing profession because it is useful for gathering information on customer behaviour (McCullough, 2011). Focus groups are also useful for assessing training needs when used in conjunction with other data-gathering methods.</p> <p>This is regarded as the most effective method for teaching problem solving and decision-making skills. As such, it is probably more useful for management than staff level training.</p>
7-Performance Appraisal Forms	<p>This is the most common method to determine training needs based on performance appraisal and is also the most widely used method in determining training needs (Brown, 2002; and Agnaia, 1996). Usually, at the end of an appraisal form, a space is provided for supervisors to state the strengths and weaknesses of the appraised employee and recommend areas that the employee needs to improve on and develop. This method is also considered to be one of the most complex and controversial techniques in the human resource field (Roberts, 2002).</p>
8-Assessment Centres	<p>After employees' selection and promotion, assessment centres are widely used to determine employees' training needs (Beck, 1983). Assessment centres involve the use of various combinations of measures to identify training needs. Examples of measures that can be used are psychometric inventories, interviews, observed performance on simulated tasks, written tests, peer ratings, role plays, in-basket exercises, business games and presentations (Osborne, 1996; and Beck, 1983). Due to the variety of exercises and multiplicity of assessors the results of assessment centres tend to produce specific, reliable and valid information regarding employees' strengths and weaknesses. This allows the most suitable training needs for the employees to be determined. However, assessment centres may not be practical for all organizations as they can be quite expensive. They may only be suitable for large and well established organizations that can afford such complicated and comprehensive training systems. Thus, this method is normally used only for senior-level employees.</p>
9-Project-based programme	<p>Incorporates formal and on-the-job training. Like action learning, learning is focused on a clearly identified and specific problem common to a carefully selected member of organizations. A short seminar to provide formal tuition on specific topics and instructions</p>

	on key issues. This is followed by a visit from the trainer to organizations of participating managers to set up a project related to the subject matter.
10- Problem oriented Exercises and Projects	The instructor giving as complete information as is needed to work on the problem under study writes up often exercises and projects. The material is distributed to the trainees in advance. The trainees are divided into groups and work separately on the problem. In the final session the groups present their reports, followed by more general discussion on the issues in hand.

2.3 Knowledge Requirements for Site Managers

Odusami et al (2007) said that as any other field of management site management includes the six stages of management, i.e.: forecasting, planning, organizing, motivating, controlling and communicating. But site management is viewed differently, from normal management functions, by some. For example, Hatchett (1976) states that site management is not a primary occupation within construction industry. People with site management responsibilities need to have some experience, of some sort, to be able to fulfil relevant positions within the industry. As such, and after spending some time in these positions, they would have developed aptitudes, and hence are able to satisfy the expectations that come with these industrial roles (Odusami et al (2007). The inter-dependency between those and attitudes, expectations, and the educational programmes that may come with the job, on one side, and the work-experience programmes.

On the other side, however, need some careful consideration. For, one need to keep in mind that the one big major responsibility, that comes with a site management job, according to Odusami et al (2007) is that the fulfilment of the contractor's obligations, as per contract conditions, that relate to the project. Hence, the site manager needs to complete all the requirements, as expressed in the contract bills and shown in the drawings, the totality of which are expounded in the articles of the agreement. The argument carries on this note, and the site manager needs to be satisfied of the quality and adherence to standards, after the approval of the supervising officer, of all the tools, equipment, materials and drawings and their suitability, for the process of completing the project, taking into consideration resources, such as time spent, cost incurred and availability of proper labour force, throughout the length of the project, as well as the overall value of the work being carried out (Obiegbu,1991).

Moreover, and from a slightly different point of view, construction site managers, according to (KiwiCareers, 2002; Odusami et al 2007; Arshad, 1997; Gunawardena ., and Jayawardane, 2002; Mustapha,1990), should, also, be familiar with the following: building standards and regulations; and building methods and materials. Those researchers, also, pointed out the obvious, in that the site manager, need to be able to read building plans and diagrams, and to purchase – after quantifying and assessing the quality and suitability of, with cost control in mind - the building materials and machinery needed for the work, as per job items and time schedule requirements. They, also, noted the possibility that the site manager might need to use planning software applications, should there is a need or a requirement to do so. Moreover, the site manager, the researchers noted, need to be aware and implement safety

precautions, methods-wise and procedures-wise, needed on building sites, as well as implementing quality control checks, throughout the length of the project, by establishing some kind of a, suitable for purpose, system, that checks all aspects of the project. In addition, they stated that, the site manager needs to put into place, an administration system, for the control, management and supervision of everything related to the completion of the project, as required. (Construction IT, 1996, Mohamed, & J.Anumba, 2006) The construction site is, therefore, seen as a key area where money is made or lost and where there is considerable scope for improving efficiency, productivity and quality. Illingworth (2000) views the construction process as a combination of two fundamental activities:

- Knowledge of handling materials and equipment.
- The skill of the workforce in the positioning of the materials and equipment (assembly) to produce the desired completed whole.

The above briefly mentioned requirements, introduces challenges, for the construction industry. One obvious challenge is that of training existing employees and recruiting and training others, to satisfy the needs of any possible project, and be able not to miss an opportunity of winning a contract, due to lack of proper resources. But before training, one need to carry out some sort of an assessment, of what are the training requirements, and which of them need to be implemented and required, for a particular job. All this is for the benefit of raising the skills standards, up to the needed job requirements level (Hassan, and Stepheson, 2004 ; Odusami et al 2007).

Therefore, it is prudent to advice and to encourage construction firms, to prepare and implement training programmes for their own existing staff, to improve their skills and knowledge, and eventually be ahead of their competitors (Mselle, and Manis, 2000). As noted by The Chartered Institute of Building (CIOB, 19975) identified knowledge areas as being needed for training purposes, which were expressed in the researches mentioned above. These knowledge areas and skills are tabularised, below

Table 2: Knowledge of site management

Working knowledge	Definition
1- Management, supervision and administration of sites	Including correspondence, minutes, RFIs, labour allocations, payroll, progress reporting, notices/claims, instruction, drawing register and technical information. General management, organization site office management, site cost control, personnel selection of operatives, workmen management, working rules agreement, safety training.
1- Delivery and materials' handling and Equipment	The activities associated with the management of deliveries and the subsequent handling of materials on site are covered including requisitions, purchase orders, material call of, GRNs and plant returns.Plant use, maintenance of equipment and mechanical plant and transportation
2- Production on-site and off-site	This considers activities supporting production for instance QA plans and reports, contract terms drawings, specifications, setting-out and measurements and also Production planning, site organization and layout,

	construction methods and site control
3- Construction Technology	General building technology including concrete technology and technical drawing, structural engineering, electrical installation, settings out and levelling
4- Quantity surveying	Standard method of measurement, compilation of bill of quantities, preparation of interim and final accounts
5- Legal, health and safety	Building regulations bylaw ,contract law (forms of contract) management of legal, health and safety requirements on sites. This considers safety policy; COSHH and CDM regulations, insurance and building regulations

2.4 Training Needs assessment to improve maintenance Engineering skills

There is a general agreement in literature that construction companies require a well trained workforce in order to make meaningful impact on the economy (Dubem et al 2012). For instance, Odusami et al. (2007) and Chan (2005) observed that skills and knowledge have become the only sources of sustainable long term competitive advantage in the construction industry. Training of site managers within the construction industry was found to be very lacking (Burgess, 1999). Most training provided tends to centre on health and safety and this because it is an industry requirement.

There is an increased need for more varied skills in the construction industry including the ability to address, not only technical, but also management concerns (Dubem et al 2012). Construction industry nowadays required a skilled construction workforce, with specific skills. Need for skilled labour is a key aspect factor for a good quality product in construction industry. According to Mulya et.al (2004) observes that the success of the construction industry in the forthcoming days will depend entirely on the quality of labours education and training. Several studies by (Odusami, 2002; Odusami et al., 2007; Charlesraj et al., 2004; Gushgari et al., 1997; Mulya et al., 2004; Farrell and Gale, 2003) have examined the important skills needed assessment in order to improve the performance of the construction industry. According to Odusami (2002), skills can be defined “*as the ability to perform the task well or better than average. Skills can also be described as the ability to translate knowledge into action*”.

The process of creating a Training Needs Assessment for maintenance engineers starts with the compilation of a list of skills which they need to possess compare to those they already have. The Training Needs Analysis (TNA) package can recognise which skills and competencies are required to maintain the plant and identify where the gaps in capability lie. The TNA will clearly indicate who needs training and what they need training in, ensuring that new knowledge and capability are acquired through the training process (Odusami et.al; 2007). Research literature suggests that whenever training programmes have to be conducted, there needs to be an assessment of the training needs which must be undertaken before anything else. Assessment of the training needs should be done in a systematic manner and should be comprehensive (Ejowhomu et.al 2006; Hassan, 2005). Organisations need to understand what training needs are before implementing training. Initially, in order to

remain competitive within the organisation, employees often have to upgrade their skills. This explains why employees need to be trained in whatever skills are needed for them to perform effectively in the organisation. Additionally, employees moving up the career ladder might need to be trained on managerial skills and leadership skills. This means that the employee may need to be trained in either technical skills or soft skills. TNA forms the basis for the training needs which need to be identified and acted upon. Once training needs are identified, then the organisation must prepare a checklist of employees who require training (Odusami et.al; 2007; Ejowhomu et.al 2006; Hassan, 2005). This would help the organisation develop a scientific method to assess how many employees need to be trained, and on what skills, and whether they have the quorum necessary to conduct the training. (www.managementstudyguide.com/training-needs-assessment.htm , 11 of May 2012). There is a growing awareness that organizations and individuals benefit from training, depending on whether the training and development programme is based on accurate analysis and is designed to address the right issues. TNA is the keystone to identify the skills gap in organisations, and it is also particularly crucial in improving skills and knowledge of employees (Hassan, and Stephenson, 2005; MMIS, 2008). Therefore it is strongly recommended that all training and development programmes must be based upon TNA if they are to be effective (MMIS, 2008). The assessment of training needs in particular skills in construction organisations is important when identifying the learning needs of the workforce. Construction employees, particularly those at management level, should possess certain skills and knowledge to achieve projects goals more efficiently (Arshad, 1997). A good TNA will also look to the long term as well as identifying the skills that will be needed in the short term. . By providing training in these skills in good time, the organisation is able to anticipate needs and have the necessary skills in place by the time they are required (Brink, 2007; Devi & Mallika Rao, 2012). The following main skills have been identified as prerequisites for successful construction organisations.

Conceptual skills: refers to the mental ability to view the operation of the organisation holistically. This implies abstract thinking and planning, and a strategic thinking ability.

Interpersonal skills: refers to the ability to work with people, solve conflict, understand people and people-related issues.

Technical skills: refers to the ability to use knowledge or techniques of a specific discipline to achieve goals. A good example of this is the understanding of the accounting, engineering or logistics and planning required to perform a task. Usually , being a manager at junior level requires a sound knowledge of technical skills. As a person is promoted up the management ladder, fewer technical skills are required.

Human skills: These include the ability of employees to work with others, communicate effectively, resolve conflicts and be a team player and to be concerned about people (Shehu and Akintoye, 2008). It has been demonstrated in many studies that the importance of employees at different levels possessing technical, human, and conceptual skills of within an organisation is crucial.

Business Skills: Razalli (2007) argues that practical business skills within an organization are necessary to achieve a corporation's objectives and targets to achieve competitive advantage by engaging in the creation of processes and systems to benchmark, learn and ensure continuous improved performance.

Project Management Skills: According to Razalli (2007) project management skills refer to the multi-faceted responsibilities necessary to plan, monitor and control all aspects of a project from conception to successful handover in line with clients' requirements, one's own organizational objectives and the implementation of best practice.

3.0 Methodology

This research investigated the core skills and knowledge needs requirement for site managers in Iraq. Quantitative research method is used in this paper for testing objective theories by examining the relationship among variables (Sanders *et al.* 2009). The research is purely deductive in nature relying on the quantitative survey approach using a structured questionnaire. A survey form was developed to facilitate the process of data collection in the data acquisition process. Questionnaires were sent to the respondents through Email to 80 site managers from different categories of construction firms; small, medium and large-scale firms. The questions were adopted from the various literature reviews and those applicable for the study were selected and improved to meet the specific requirement of local. Data were collected through a structured questionnaire, designed using an adopted Likert-type 5-point scales. The "mean score" method was adopted to establish the relative importance of the variables to be used in assessing the training needs of site managers. The "mean score" is mathematically represented as:

$$MS = \Sigma(F * X) / N. (1 \leq MS \leq 5)$$

Where "X" is the score or weight given to each variable by the respondents and ranges from 1 to 5 where "1" is not significant and "5" is most significant; F is the frequency of responses to each rating (1-5), and "N" is the total number of responses concerning that variable.

The study aimed at discovering the skills and knowledge deficiencies existing among construction site managers. This will help to identify their training needs

4.0 Results and Discussion

4.1 The important of TNA

As shown in Table 3, the mean score for all the respondents is 4.25. This indicates that majority of site managers under study (48 % of the respondents) considered training very important. This correlates with the opinion given by brown (2002) that training is critical for any industry that must remain competitive in a technologically complex and ever changing world.

Table 3 : The important of TNA perceived by site managers

The important of TNA	Number of responses
1 – Not important	0
2– Slightly important	0
3 – Moderately	13.6 % (11)
4 – Important	48.1% (39)
5 – Very important	38.3% (31)
Total	81
Mean score	4.25

4.2 Preferred Delivery Training Needs Methods

The weighted average in Table 4 represents the preferred delivery training needs methods by the site managers. All the site managers gave priority to field visit, followed by focus group, questioner and Problem-oriented exercises and Projects. The site managers believed that firms should have a system of field visits mostly on weekend basis. Thus, this finding gave credibility to that of Ogunlana et al (2002) that contractor's employees prefer on-the-job site visit training and should be of regular nature. Theoretically, field visit enhances not only the cognitive learning outcome; it has significant impact on the affective domain of the learning Ilogu (1998) believes that there is a sort of overlapping in the three domains of learning: cognitive, affective and psychomotor. This training delivery method must recognize these domains and incorporate this into whatever system being deployed. This method is useful when the job is observable and measurable and can be analysed in terms of which SKAs are required to perform the job effectively.

Table 4: Site Manager's priority for training needs methods

Descriptive Statistics			
Training needs methods	N	Mean	Std. Deviation
1- On site visit observation	81	4.3951	.62608
2- Focus Groups	81	3.8025	.65992
3- Questionnaires	81	3.5679	.80527
4- Problem-oriented Exercises and Projects	81	3.2346	.72924
5- Delphi Method	81	3.1975	.53432
6- Assessment Centres	81	2.9012	.70009
7- performance appraisal	81	2.8642	.58637
8- Document Reviews / Examinations	81	2.6296	.64118
9- Project-based programme	81	2.6173	.69943
10- Advisory Committee	81	2.4938	.76032
Valid N (listwise)	81		
a. What is your position in your company = Site manager			

4.3 Skills and knowledge Needs Assessment

For the construction professionals, there are certain basic and important skills and knowledge that are expected of them. These skills and knowledge are better learned at academic institutions and preferable, at tertiary institutions (Chan et al., 2002). In essence, they needed to be placed in a more appropriate educational framework to ensure their continuing relevance. With the recent developments in the industry and the recent explosion of information technology, the academic institutions are finding it almost impossible to disseminate all pertinent and available information and skills relevant to these professions. Alshawhi et al. (2007) captioned this very well in that

traditional training and education models currently in use are often criticised for the lack of coordination between the industry needs and the actual training/education delivered. This dichotomy is often characterized as ‘skill and competence gaps.

Training need gap is calculated not just based on the skills possessed by the employees. It takes two dimensions. One the importance of a skill and knowledge for successful performance of the job and second the extent to which the employee has that skill. Certain skills are more important when compared to others. If the skill and knowledge is more important and the employee does not have that them, the training need gap will be more. On the other hand if the skill and knowledge is less important and the employee does not have that them the training need gap will be less. The respondents were asked to rate the importance of a skill and knowledge and the extent to which they have that skill and knowledge. Based on this, the training need gap for different skills and knowledge is calculated and the mean scores are presented in Tables below.

Table 5: Mean scores of training need cap of different skills, and the Independent Sample T-Test of important of skills needs

Skills types	Frequency response of rate the importance of skills					Training need gap mean score	
	1	2	3	4	5	M	R
Project management skills	0.0% (0)	0.0% (0)	0.0% (0)	18.5% (15)	81.5% (66)	4.81	1
Technical skills	0.0% (0)	0.0% (0)	0.0% (0)	38.3% (31)	61.7% (50)	4.62	2
Interpersonal Skills	0.0% (0)	0.0% (0)	13.6% (11)	48.1% (39)	38.3% (31)	4.25	3
Human skills	0.0% (0)	0.0% (0)	38.3% (31)	55.6% (45)	6.2% (5)	3.68	4
Conceptual skill	0.0% (0)	2.5% (2)	54.3% (44)	43.2% (35)	0.0% (0)	3.41	5
Business skills	0.0% (0)	11.1% (9)	65.4% (53)	23.5% (19)	0.0% (0)	3.12	6

1- Not important; 2-somehow important; 3-not sure; important; 5- very important

To what extend do engineering groups have these skills

Skills type	Frequency response of rate the extent to which they have that skills					Training need gap mean score	
	1	2	3	4	5	M	R
Project management	44.4% (36)	55.6% (45)	0.0% (0)	0.0% (0)	0.0% (0)	1.47	1
Technical skills	43.2%	53.1	3.7%	0.0%	0.0%	1.60	2

	(35)	% (43)	(3)	(0)	(0)		
Interpersonal Skills	9.9% (8)	61.7% (50)	28.4% (23)	0.0% (0)	0.0% (0)	2.19	3
Human skills	0.0% (0)	37.0% (30)	60.5% (49)	2.5% (2)	0.0% (0)	2.65	4
Conceptual skill	0.0% (0)	9.9% (8)	81.5% (66)	8.6% (7)	0.0% (0)	2.99	5
Business skills	1.2% (1)	4.9% (4)	43.2% (35)	50.6% (41)	0.0% (0)	3.43	6

(1 -Poor. 2 Fair. 3 average. 4 Good. 5 Excellent)

From this table, it can be seen that from first part the most important skills come with the highest mean item score is project management (4.81) followed by technical skills (4.62). On other hand, it shows from second part the less skills possessed is project management with mean score (1.47) followed by technical skills with mean score (1.60).

So it is observed from the table that the training need gap is not much for all the skills as perceived by the all groups in this survey. Of all the skills, the training need gap is relatively more for project management skills followed by interpersonal skills. These areas need more attention and assessment from training point of view. The training need gap is the least conceptual skills, followed by business skills. Organized continual training on Project Management in Construction is therefore need of the hour for Iraq construction site manager due its important role in success of construction project. Therefore, Iraqi construction companies need to create more awareness on the benefits of project management skills, techniques skills and processes. It is also recommended that site manager should have Project Management skills and must be an intrinsic part of their professional curriculum so that an engineer who graduates is well versed technically as well as managerially and can contribute more effectively in the growth of Iraqi Economy.

Table 6: Mean scores of training need cap of different knowledge , and the Independent Sample T-Test of important of knowledge needs

Skills types	Frequency response of rate the importance of knowledge					Training need gap mean score	
	1	2	3	4	5	M	R
Management, supervision and administration of sites	0%	0%	0%	21.8%	78.2%	4.78	1
Delivery and materials' handling and equipment	0%	0%	2.5%	40.6%	56.9%	4.54	2

Production on-site and off-site	0	0	16%	49.8%	33.5%	4.17	3
Construction technology	0%	0%	27.6%	54.8%	17.6%	3.90	4
Quantity surveying	0.0%	2.1 %	38.9%	54.0%	5.0%	3.62	5
Legal, health and safety	0.0%	5.4 %	57.3%	33.9%	3.3%	3.35	6

1- Not important; 2-somewhat important; 3-not sure; important; 5- very important

To what extend do engineering groups have these knowledge

Skills type	Frequency response of rate the extent to which they have that skills					Training need gap mean score	
	1	2	3	4	5	M	R
Management, supervision and administration of sites	44.4 % (36)	55.6 % (45)	0.0 % (0)	0.0 % (0)	0.0 % (0)	1.56	1
Construction technology	50.6 % (41)	39.5 % (32)	9.9 % (8)	0.0 % (0)	0.0 % (0)	1.59	2
Production on-site and off-site	29.6 % (24)	53.1 % (43)	17.3 % (14)	0.0 % (0)	0.0 % (0)	1.88	3
Delivery and materials' handling and equipment	0.0 % (0)	51.9 % (42)	45.7 % (37)	2.5 % (2)	0.0 % (0)	2.51	4
Quantity surveying	0.0 % (0)	11.1 % (9)	66.7 % (54)	22.2 % (18)	0.0 % (0)	3.11	5
Legal, health and safety	0.0 % (0)	13.6 % (11)	50.6 % (41)	35.8 % (29)	0.0 % (0)	3.22	6

(1 -Poor. 2 Fair. 3 average. 4 Good. 5 Excellent)

It is observed from the table above that the training need gap is not much for all the knowledge as perceived by site managers in this survey. Of all the knowledge's, the training need gap is relatively more management, supervision and administration of sites with mean score (1.56), followed by construction technology with mean score (1.59). These areas need more attention from training point of view. The training need gap is the least legal, health and safety, followed by quantity surveying.

It can be seen from the above tables that Iraq has an engineering culture which focuses mostly on technology instead of people, and is rather disorganised in terms of

staff development. Therefore, construction project management skills are very poorly represented among employees and yet they are recognised as important skills needed in construction projects (Ford et al., 2000; Loosemore et al., 2003). The construction sector in Iraq suffers from a deficiency of the right calibre management, in general, and a lack of proper construction projects management, in particular. This is due to the dissemination of a cultural of: concentrating on technical expertise development; not paying proper attention to the advancement of the individuals' aptitudes; and not improving construction knowledge-base, as a whole. This in turn, can be attributed to the: sanctions epoch; indifference of the top management, in taking-up improvement exercises, seriously enough; and tribal factors, that interfere with the assessment of employees' needs, through favouritism - thus negatively playing a part in the recruitment process of personnel, for training and general skills improvement purposes. One of the issues that emerges from these findings is that the TNA approach in developing countries is totally neglected, as this known as the best method for effective outcomes of training for organization (Abu-Doleh, 2004).

5.0 Conclusion and recommendation

The construction industry in Iraq has a key role to play in its developing industrialisation. The majority of the construction industries are largely low technology, low skill and knowledge labour. Training helps the employees to equip themselves with better knowledge and skills. The training needs for the Iraqi construction employees have to be properly identified and they could be sent to some workshops and increase their awareness on the new updates in the construction project management skills and technical skills with knowledge management, supervision and administration of sites followed by production on-site and off-site in the field of construction industry.

There is definitely a skill and knowledge needs facing the Iraqi local construction industry hence the need for training is evident. Recognition that training is the most appropriate course of action for improving the performance and efficiency of construction engineering workforces is agreed by practitioners, academics, government agencies, professional institutions and clients of the construction industry. Such a concern stems from the realisation that the industry must endeavour to provide a truly professional service or product which is qualitatively superior and gives value for money. This paper presented a background of the skills crisis in construction. The Iraqi construction industry is facing most common problems such as management admin site and communication problems and also lacking skills and knowledge of inadequate pool of workforces. This is attributed to several factors including insufficient training programmes. TNA in Iraqi construction should be performed to avoid the risk of overtraining and undertraining programmes. TNA is conducted to identify specific skills and knowledge problem areas and to determine the associated costs of training programmes and their respective benefits. Workforce skills and knowledge needs in Iraq were determined based on survey questionnaires to facilitate the process of data collection. The results of survey questionnaires were analysed and interpreted. The results revealed that. The need for improved performance of construction engineering workforce highlighted the focus on more project management skills and management and supervisor knowledge. Consequently, training needs has been considered an essential issue amongst construction companies in Iraq. The progressive open and competitive market felt by the Iraqi construction industry has enhanced the need for superior skills and competencies of managers and

engineers involved in management of construction projects. Accordingly, the training needs of Iraqi construction engineers have been addressed through the survey study, and not surprisingly, results reflect the desire of the construction industry for more skills and knowledge for promoting project efficiency. This is understandable keeping in mind that the nature of construction required more organization skills as well as an in-depth technical knowledge of construction processes compared to other sectors. The above implies Iraqi engineering need more assessment for project management skills and management site and supervisor knowledge and it notices that there is a distinction on views of skills and knowledge area needs between Iraqi engineering.

The finding of this study also suggests that the absence of needs assessment in Iraq is due to lack of expertise, lack of management supports and it is irrespective of the size of firms. Indeed, this finding has been endorsed by other studies (see for example, Anderson, 1994; Sadler-Smith et al, 1998; Heraty & Morley, 2000; Elbadri, 2001; Budhwar, et al., 2002; Hansen, 2003; Hill & Stewart, 2000; and Hill, 2004). *The study also found significant differences in TNA practices of organizations as discussed earlier. And also companies there were significantly different in terms using of competency analysis technique in Iraq construction companies.*

Having identified the related problems that affect this study and carefully analysed the relevant data, the following conclusions have been arrived at:

- There is common agreement that training needs of construction site managers should address human and industrial relations skills, building production knowledge and project management skills.
- Site managers considered training needs assessment very important as it makes them cope with the rapidly changing world and sorting organisational problems.
- Field visit for site managers is concluded as the most preferred delivery method.

In order to cope with the competitive and dynamic nature of construction site works, site managers' training should address human and industrial relations, building production and project management, communication skills and computing and to resolve the construction workforce crisis in Iraq some suggestions were provided to rehash the skills of technical school graduates and training centre trainees. Some other recommendations were provided to serve the construction sector in general, such as

- Frequent needs assessment of site manager should be seen as important and encouraged so as to put an end to the problem of skill and knowledge shortages.
- Field visit, as a preferred delivery method for the training of site manager and should be encouraged and site-documentary bank should be developed, stored and made accessible to future generation of site workforces. This can also be used for training at educational institutions and at continuous professional development in Iraq.
- raising construction companies' awareness of the importance of needs assessment and competency-based training and certification considering the number of tested and certified labourers as one of the criteria for classifying construction contractors and accreditation

- introducing competency-based training and assessment programmes that target the use of new technology in construction equipment encouraging employers and workforce mobility and exchange. As such, the construction sector can work on the trades that require a high priority in training in order to enhance and build the capacity of construction workers

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The Use of Benchmarking in Facilities Management in Selected Cities in Nigeria

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Abstract

The paper examines the application of benchmarking among Nigerian FM practitioners. Data collection was through self-administered questionnaires sent to 120 facilities management organisations in Lagos metropolis, 50 in Abuja and 15 in Port Harcourt. The results of the survey were supplemented with interviews with 18 facilities management heads in the study areas. The survey achieved a total response rate of 76% in Lagos, 58% in Abuja and 87% in Port Harcourt Respectively. Overall, most benchmarking practices are low although a sizeable number claim to practice benchmarking, the practice of benchmarking is still limited. Also, there is no significant difference in extent of use of benchmarking in the contribution by FM organizations' location. The study will help to identify areas that need improvements in FM practice and promote growth of the nation by preserving the country's investment in assets.

Keywords

Benchmarking, Facilities management, Nigeria, Organizations.

Introduction

Global economic crisis and fast advancement of information technology have changed the way businesses of today operate a great deal. This has made mainly businesses that are very cost effective and capable of making breakthrough improvements within a short period of time to be major players in the current ever changing business environment. Facilities management has the potential to improve processes by which workplaces can be managed to inspire people to give of their best, to support their effectiveness and make a positive contribution to economic growth and organizational success (Alexander, 2003). The application of facilities management (FM) and benchmarking in FM in particular are practices that are yet to gain wide acceptance in Nigeria. In the 1980s, Facilities management itself was introduced as a result of globalization from countries which have good standards of maintaining the built environment. It was introduced at first by multinational organisations in the oil industry such as Chevron and Mobil as part of their relocation activities.

Benchmarking is a continuous analysis of strategies, functions, processes, products or services, performances, etc. compared within or between best-in-class organisations by obtaining information through appropriate data collection method, with the intention of assessing an organization's current standards and thereby carry out self-improvement by implementing changes to scale or exceed those standards (Anand &

Kodali, 2008). A major function of the benchmarking process is to measure against outstanding contemporaries in order to achieve improved performance (Ho et.al, 2000). Facilities management benchmarking in Nigeria serves both the purposes of helping companies to have an external focus and finding industry best practices by constantly comparing their own performance against that of others. According to Williams (2003) facilities expenditure takes up to 15% of an organisations yearly budget and benchmarking can help to justify the investment made in facilities thus improving the recognition given to facilities within the organisation.

Although Facilities management has been introduced into the country about thirty years ago, the practice according to Akintunde (2009) is still being threatened by lack of benchmark standards and data, misconceptions about the practice of FM, inadequate industry knowledge and experience as well as corrupt practices in processing of contracts. These developments has brought about lack of professionalism in the industry and resulted in loss of jobs to foreign firms. There is also limited use of benchmarking in Facilities management in Nigeria.

The issue of Benchmarking in Facilities management has been a subject of discussion by both academics and practitioners for over 15 years mainly in the UK, USA, Europe, Asia and Australia (Varcoe, 1996, Massheder & Finch (1998a), Massheder & Finch (1998b), Ho et.al (2000), Stoy (2007), Lai & Yik (2008), Madritsch (2009), Roka-Madarasz (2010), Bailey & Mc Lennan (2010) . There has been no evidence of such a study in developing countries such as Nigeria especially studies which are multi-sector focused.

The research question is to find what is the extent of use of benchmarking in facilities management among Nigerian FM practitioners and the research hypothesis is to find out if there is significant difference in extent of benchmarking in the contribution by FM organisations location.

Literature Review and Theoretical Propositions

1.1 Formal and Informal Benchmarking

According to Adebajo et al., (2010) benchmarking itself is a formal process that uses comparison approaches and models, informal approaches to benchmarking exists from experiences of organizations. Formal and informal benchmarking is described as follows:

- (1) Informal benchmarking – is benchmarking that does not follow a process or a procedure. It refers to the type of benchmarking that everyone does at work, often unconsciously, involving comparing and learning from the behaviour and practices of others.
- (2) Formal benchmarking can be in the form of performance benchmarking and best practice Benchmarking. With these types of benchmarking, it is further divided into internal, competitive or functional organisation comparison:

1.2 Studies on the use of Benchmarking in Facilities Management

Benchmarking literature abounds across various disciplines with successful examples and cases in developed countries adopting benchmarking , but very little has been reported on benchmarking issues in developing countries. Several studies have been undertaken to investigate benchmarking concepts in different countries, for example the USA, Canada, UK, Europe, Australia, New Zealand, Brazil, China, Singapore,

Malaysia, India, Indonesia, Kuwait, Korea, South Africa, Egypt, Morocco (Coopers & Lybrand, 1994; Delbridge, ; Cook & Macaulay, 1996; Elmuti & Kathawala, 1997; Longbottom, 2000; Hinton et al., 2000; Brah et al., 2000; Kumar and Chandra, 2001; Jarrar and Zairi, 2001; Vermeulen, 2003; Yusuff, 2004; Deros et al., 2006; Anand & Kodali , 2008; Jain et.al, 2008; Magd, 2008; Marwa & Zairi, 2008, Asrofah, Zailani, & Fernando, (2010), Cocks, 2012) and others

In the Field of Facilities management, there is not much empirical work that has been done in Nigeria. Most of what has been done empirically is in western countries such as Great Britain, Europe and Asia. The studies were able to capture perception of benchmarking, distinction between benchmarking and performance measurement and benchmarking metrics but were not explicit about benchmarking in facilities management in developing countries and a holistic approach to benchmarking.

Table 1: Summary of Some Empirical Studies in FM Benchmarking

Authors	Country	Methodology	Results	Shortcomings
Kincaid (1994)	UK	Presented in a pedagogical discourse the basis for measurement of performance in FM with reference to benchmarking and other measurement systems. He went on to consider these methods in relation to cost control, cost effectiveness and value	Benchmarking has been brought into a facilities management context as a form of performance measurement, rather than a distinct process reliant on performance criteria.	The focus of this study has been on the performance measurement aspects of benchmarking in FM rather than exploring the issues surrounding the process. This paper was based on theoretical arguments and not on empirical assessments
Massheder and Finch (1998)	UK	Study was part of a two-part report which took account of the broad range of company sizes and activities that use office space, looking specifically at the UK situation. They surveyed the metrics used by the top 100 UK organisations.	The most common metrics reported by Massheder and Finch (1998a) related to occupancy cost and operational space: readily available quantitative information.	This directly conflicts with the academic push to widen the scope of benchmarking into concerns like customer satisfaction, service standards, and spatial measures
Ho <i>et al.</i> (2000)	Asia pacific region	Survey investigated the perception and current practice of FM benchmarking metrics in the region	The study on the preference and use of individual metrics can be used as a guideline for the development of standard benchmarking metrics list for companies in the region	It is expected that findings of the study on similar study population in a different national context will vary

Stoy (2007)	Switzerland	An occupancy cost benchmarking concept was explained using the example of a Swiss portfolio of office buildings used for own operations.	Benchmarking concept enables the benchmarking of comparable properties and allows the reasons for cost differences between the properties under consideration and the specific benchmarks to be identified	The concept discussed did not cover other areas of application.
Lai & Yik (2008)	Hong Kong	Benchmarking study on ten luxury hotels with the aim of identifying the significance and performance of various operations and maintenance (O&M) cost elements. A benchmarking club was set up for the practitioners participating in the study	The authors found that energy cost dominated the O&M expenditure of hotels. The cost for maintaining lifts and escalators constituted a major part of contract maintenance costs	The study was restricted to only hotels and use of cost benchmarks. Also, quality, age and occupancy rate of hotels are factors which need further work to investigate their effects on O&M costs
Róka-Madarász (2010)	Hungary	A survey on appropriate methodologies and techniques of Facilities Management benchmarking was carried out and questionnaires were mailed to members of HFMS (Hungarian Facilities Management Society) and the MAISZ (Hungarian Real Estate Association).	The study categorized environmental, health, janitorial, cleaning, maintenance and utility costs by facility type, industry, age, main function, and others. The study also used staffing and utility consumption data for more than 199,482 square metres of facilities	However, the number of samples used was relatively small, and did not cover property investors and the real-estate market. Also some types of facilities like retail and hotels were excluded from the study

A glean at table 1 above shows that while there have been many studies conducted in the past they have been done in advanced countries, also some of the papers have confused performance measurement with benchmarking, some have relied on scanty sample size, others have focused only on cost benchmarking, and some have restricted themselves to conduct only a particular sector.

This study will advance these limitations through an empirical assessment of benchmarking practice that can be generalisable across major cities where facilities management organizations are found in a developing country. Its focus is also not only on use of cost benchmarking but on other types of benchmarking as well. Also the underpinning theory for this study is Xerox presented by Camp (1989) and is tested empirically by this work by looking at analysis, integration and action steps of benchmarking although Camp's model contains planning or preparation, analytical, integration and action phases. The Xerox benchmarking process model has been

highly cited and quoted in literature. Hence, it is assumed that it is the most commonly used models by practitioners. Further, the Xerox model has been used for quite a long time without any modifications. Hence, it could be improved and evolving best practice can be incorporated within this model (Anand & Kodali, 2008). A framework for benchmarking applicable to the Nigerian context will be developed later. Other models which could be used are that of the EFQM, that of Bhutta and Huq (1999), Zairi and Baidoun (2003), Marwa & Zairi (2010) and others but are too process oriented, it is costly to implement and amount of effort and investment required participating. The models are hardly used by small businesses and non-multinationals and focused on advanced countries.

Planning involves identification of benchmarking subjects and partners. These include determination of data collection methods and collect data, then determine current competitive gap and project future performance. Integration involves communicating findings and gaining acceptance. Lessons learned should be established. Then functional goals will be achieved from lessons learned from the process both for the facilities manager and the industry. Under action, you develop action plans, monitor progress and then benchmark.

Research Methodology

The data used in the study is made up of data collected on variables of the same sample at one point in time (Cross-sectional study). Findings from a literature review, interview with two facilities managers were used for the design of self administered questionnaires. These questionnaires were validated by two facilities managers and two senior academic researchers and later piloted. The questionnaire was again refined from experience gathered from the Calibration of the *Estatesmaster* benchmarking programme for use in Nigeria and other countries at the International Facilities and Property Management Information Limited, UK and again pre-tested. Self-administered questionnaires have been known to give higher response rates for studies in the Built Environment in Nigeria (Olaleye, 2000).

The sample frame for FM organisations in Lagos, Abuja and Port Harcourt is 237 organisations. Questionnaires were administered in June 2012 on 120 facilities management organisations in Lagos metropolis obtained from the International Facility Management Association list. The International Facility Management Association (IFMA) is the professional body that offers guidance and trains facilities managers in Nigeria, many of the established facilities managers are registered with this body. The responding organisations were sampled using the simple random sampling method to minimise bias while all the respondents in Abuja and Port Harcourt were sampled due to small sample size. 91 questionnaires were retrieved resulting in a response rate of approximately 76%, 50 in Abuja and 15 in Port Harcourt. Lagos in the South West is an ideal study area because it is the business nerve centre of Nigeria, which houses several of Nigeria's large corporations that require facilities management services. Abuja in the North is the Nation's capital with its premier state of infrastructure has ever growing need for commercial and residential real estate. Port Harcourt in the South East is Nigeria's oil and gas business hub ranks next to Lagos and Abuja and houses the head offices of many oil and gas companies as well as related companies.

The results of the survey were supplemented with interviews with 18 facilities management heads in the study areas to further explore contextual conditions for

the extent of benchmarking in facilities management in Nigeria. Preceding the main survey, the questionnaire was piloted and necessary modifications were made. The survey achieved a total response rate of 76% in Lagos, 58% in Abuja and 87% in Port Harcourt Respectively.

Questions asked were centred round the research question. Questions asked centered on the company characteristics of the respondents such as the size, geographical coverage, size of buildings managed, FM budget and FM training undertaken by staff of the FM department. The second section focused on whether there has been conduct of benchmarking project and benchmarking practices implemented by the FM department. The practices are broadly, measurements, comparison, application and implementation. The reliability of scale for the questions was tested and the reliability of 32 item in the instrument using Cronbach's Alpha is obtained as 0.981 (98.1%) with mean scale statistics of 1.868 and variance (Var) of 0.306. The result suggested that the instrument of evaluation (questionnaire) is highly reliable judging from the fact that $98.1\% > 70\%$, which further implied that there is an internal consistency of the items in the instrument (questionnaire) used for data collection. The data is analyzed with the aid of Statistical Package for Social Science (SPSS). Presentation of data is made using grand mean and one way analysis of variance.

Findings and Discussion

As found in the company characteristics of the respondents, 41 (31.3%) of the companies surveyed are small companies, which are companies 50 and under in terms of employee size. Another 15 (11.5%) are medium sized (51- 250) while majority 75 (57.3%) are large companies (above 250 employees. 49.2% have wider coverage in terms of location than Nigeria. Most of the organisations surveyed have a space of between 100,000 square metres and 250,000 square metres 44 (37%), this is followed by a space of less than 100,000 square metres 34(28.6%), 16 (13.4%) have a space of between 250,000 square metres and 500, 000 square metres, 13 (10.9%) have between 500,001 to 750,000 square Only 12 (10.1%) have a space of 1,000,000 and above square metres. 1(0.9 %) have a budget of less than N1m, 13(10.4 %) have a budget of N1-5 million, 28(22.4 %) have a budget of 6-15 million, 19 (15.2%) have a budget of N16-30 million, 20 (16%) have a budget of N20-50 million, while 44 (35.2%) have a budget above N50 million. 29 (30.5%) have only Msc, 17 (17.9%) have only undergraduate degree in FM, 15 (15.7%) have only FMP, 12 (12.6) possess only CFM. 5 (5.3%) possess other training in FM.

Extent of Benchmarking

The extent of benchmarking as shown in figure 1 below revealed that majority (58%) said they do conduct benchmarking while a sizeable number (42%) said they do not conduct benchmarking. The extent of performance of formal and best practice procedures is however captured in the subsequent section (see table 2 below and the discussions that follow). Previous studies showed that the use of benchmarking was low in FM (Massheder & Finch, 1998, Ho et al., 2000; Loosemore & Hsin 2001). Bailey & McLennan (2010) however found in a later study that the practice of benchmarking is fair. It will then be useful to find out the practice of formal benchmarking as a recent global study by Adebajo et al. (2010) across various sectors of the economy and various countries showed that the adoption of formal benchmarking is low.

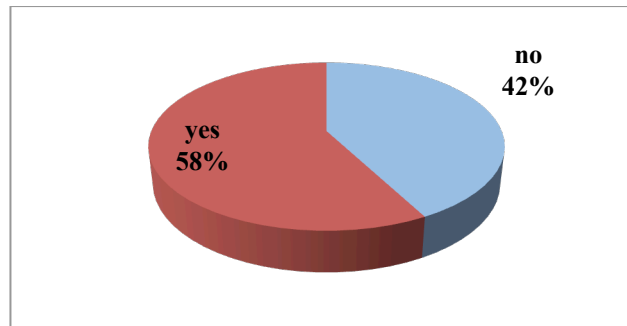


Figure 1: extent of benchmarking

What is the Extent of use of Benchmarking among Nigerian FM practitioners?

To resolve this research question, questions were asked on a 5 point ordinal scale (1= not yet considered; 2= just being worked out; 3= already in use but not frequently used; 4 = fairly frequently used; 5= already in constant use). These questions revolve around four aspects of benchmarking namely measurements, comparison, application and implementation derived from literature (Camp, 1989; Williams, 2000; Ellis et al., 2001; Williams, 2003; Wauters, 2005; Williams, 2009; Anad & Kodali, 2008). Also covered were questions that deal with best practice in benchmarking (as previously identified in a study by Anad & Kodali, 2008) as well as use of formal procedures in benchmarking (as previously identified in the study of Adebajo et al. (2010)). These questions cover the analysis, integration and action steps of benchmarking model developed by Camp (1989) which is the model that underpins this study. The details of the variables used are contained in the next section on ANOVA. Grand mean score is used to answer this research question (see table 2 below).

In the three locations practice of benchmarking is highest in Port Harcourt in all four practices, and then followed by Lagos and then Abuja. This may be due to the fact that there is high presence of oil and gas multinational organisations with structure and their own policies in Port Harcourt have made their FM departments to align with organisational demands for benchmarking. Although sector based benchmarks are found, you rarely find formal FM benchmarks. In Lagos where the cost of maintenance is higher than in Abuja and there is the presence of training programmes in FM which have raised the profile of FM in the city, also the practice of FM itself started with Multinational oil and gas companies in Lagos.

Overall, all benchmarking practices are low: measurement (mean =2.9, S.D=1.01), comparison (mean = 2.46, S.D = 0.90), application (mean= 3.08, S.D= 1.09) and implementation (2.91, S.D = 1.09). This shows that the practice of formal benchmarking is low in Nigeria although 58% claim they benchmark. The reasons for these are found under the interview section. This finding from the survey is also similar to those of Massheder & Finch (1998) in the UK and Ho et al. (2000) who found that the practice of benchmarking was low in the UK and the Asia Pacific region respectively but slightly different from a later study of Bailey and Mc Lennan (2010) who found that the practice was fair in the public sector in the UK.

To resolve the hypothesis that:

H₁: there is no significant difference in extent of use of benchmarking in the contribution by FM organizations' location

H₀: there is significant difference in extent of use of benchmarking in the contribution by FM organizations' location

One way analysis of Variance was used. ANOVA is a statistical technique designed to analyse the significance of the mean differences of the different populations and is used in cases when we need to study the relationship between nominal or ordinal variables, and interval variables. The ANOVA technique indicates whether or not we reject the null hypothesis that reflects the equal means value for each a level of significance (Garrigós-Simón, Marqués and Narangajavana, 2005). In this way, we confirm whether the mean of the variable use of FM benchmarking is significantly different for location of Facilities management organizations.

Table 2: Extent of Use of Benchmarking

Benchmarking Practices		N	Mean	Std. Deviation
Extent of Measurements used	Lagos	89	2.9585	.99105
	PHC	13	3.0982	1.07310
	Abuja	22	2.5995	1.01750
	Total	124	2.9094	1.00722
Extent of Comparisons used	Lagos	89	2.4441	.78338
	PHC	13	2.8094	1.24356
	Abuja	22	2.3423	1.09783
	Total	124	2.4643	.90069
Extent of Applications used	Lagos	84	3.0089	1.00084
	PHC	11	4.0682	.89351
	Abuja	22	2.8598	1.29314
	Total	117	3.0805	1.09257
Extent of Implementation used	Lagos	84	2.8661	.99466
	PHC	10	4.0200	.90160
	Abuja	22	2.5545	1.24201
	Total	116	2.9065	1.09182

**Ratings used = 1= not yet considered; 2= just being worked out; 3= already in use but not frequently used; 4 = fairly frequently used; 5= already in constant use*

For the purpose of analysis grouping variables were adopted for benchmarking practices measured in this work. They are:

Measurement and it covers regularly keeping of cost data, receipt of award in recognition of performance, conversion of the data to units of measurements, classification of measurements using protocol, probe further into analysis of performance and Use of formal tools.

Comparisons and it covers gathering of information from others, sharing information regularly, cooperation with other organizations on data collection, comparing facilities procedures, practices internally, comparing procedures with others, probe further into performance, use of IFMA benchmarking exchange, use of Building Cost

Information Service, use of Property Benchmarking Service, use of maintenance and cleaning costs and use of other tools for benchmarking.

Application covers application of lessons learned from performance comparison, using lessons to improve performance, having a monitoring and control system in place and having difficulties in application of lessons learned from comparison.

Implementation covers used in drafting facilities plan, used to manage budget or funds, used to decide the best purchasing procedures, used to demonstrate improvements and has gained senior management support.

Table 3: Analysis of Variance of Location and Use of Benchmarking

		Sum of Squares	df	F	Sig.
Extent of Measurements used	Between Groups	2.791	2	1.384	.254
	Within Groups	121.991	121		
	Total	124.782	123		
Extent of Comparisons used	Between Groups	1.913	2	1.182	.310
	Within Groups	97.871	121		
	Total	99.784	123		
Extent of Applications used	Between Groups	12.232	2	5.523	.005
	Within Groups	126.239	114		
	Total	138.471	116		
Extent of Implementation used	Between Groups	15.261	2	7.078	.001
	Within Groups	121.826	113		
	Total	137.088	115		

The results at 0.05 level of significance showed that there is no significant difference in the use of measurement ($F = 1.384$, $p = 0.254$), comparison ($F = 1.182$, $p = 0.310$) of benchmarking practices and location. Also there is significant difference between application ($F = 5.523$, $p = 0.005$) and implementation practices ($F = 7.078$, $p = 0.001$) of benchmarking and location of FM organisation. Overall, there is *no significant difference in extent of use of benchmarking in the contribution by FM organizations' location* ($F = 2.755$, $p = 0.068$). We therefore accept the main hypothesis and reject the null hypothesis (see table 4 below)

Table 4: Analysis of Variance of Overall Location and Use of Benchmarking

		Sum of Squares	df	F	Sig.
Overall Benchmarking Extent Used	Between Groups	4.302	2	2.755	.068
	Within Groups	95.247	122		
	Total	99.549	124		

Interviews for Extent of benchmarking in FM in Selected cities in Nigeria

18 heads of Facilities management organizations were interviewed on between October 2012 and December 2012 in Lagos, Abuja and Port Harcourt. Two were head

of facilities departments of multinational oil and gas companies, 3 consultants, 2 from the banking sector, 1 from an events centre, 2 from estate surveying and valuation firms, 2 from public sector organizations, 3 from construction companies, 2 from investment companies and 1 from a telecommunication company.

The questions asked the respondents during the interviews were on types of benchmarking programs used in your unit, the cost drivers, if the results from the benchmarking are applied and implemented and how? Is the practice of benchmarking in Nigeria formal or informal?

The interview with the facilities managers revealed the following:

- Practice of Benchmarking and types of benchmarking programmes used: 5 of the respondents do not use any form of benchmarking. 1 use the FMbenchmarking.com which is an online tool that helps to compare the performance of properties as well as best practices in different regions of the world. 2 felt that you can use “Microsoft Access or “Good planner” a space planning software for FM benchmarking. 2 use the IFMA questionnaire while others which are in the majority rely on market information for benchmarking. When market information is used peer review discussion networking is adopted or a survey is conducted of the market. Sometimes ratio of cost of services abroad is compared to cost of services at home. The use of qualitative benchmarks is few. This shows the informal nature of benchmarking; also majority (89%) of those interviewed said the practice of benchmarking is informal because it is difficult to get access to comparable and accurate information for benchmarking. Then there is low use of information technology. This confirms the findings obtained from the questionnaire survey as well.
- Cost drivers useful and used in benchmarking: 22% of those interviewed said the cost of power or diesel pushes up cost of maintenance. This factor accounts for up to 50% of the FM budget sometimes due to incessant power outages. 11% attributed cost driver to be cost of installation of imported materials as well as cost of maintenance of such materials, the cost of importation as well as cost paid to its maintenance personnel affects FM cost. Another factor is presence of unskilled artisans because the FM has to keep paying for the same service. 22% said building material cost is a driver. Also the users are sometimes unwilling to pay for services rendered by the facilities manager. The market is burdened by the Chinese market which is responsible for presence of substandard building materials, materials bought from this market will need to be replaced several times. 11% said type of facility is a driver. Other factors identified were service levels, wages, market forces or economic circumstances and Location. Location is a factor because some parts of the country are still inaccessible when you want to get materials from one point to another.
- Implementation of Benchmarking: 11% said benchmarking is used for customer satisfaction. 39% do not implement the exercise, one person use it to prepare budgets, 11% use it for selection of vendors or contractors, one use it to fine tune business approach. Others use benchmarking to develop their processes and for taking decisions. Only one uses the tool to prepare a strategic FM policy.

Conclusion and Further Research

The paper reported the findings of a survey on the application of benchmarking in FM in Lagos Nigeria which is a descriptive research. Overall, most benchmarking

practices are low and there is no significant difference in extent of use of benchmarking in the contribution by FM organizations' location. There is hardly any use of formal benchmarking tools as confirmed in both the survey and interviews. Contextual factors which drive cost for benchmarking are high cost of maintaining imported equipments, cost of diesel, substandard products, accessibility, presence of unskilled artisans and security threats. There is also very low use of quality benchmarks. When benchmarking is used it is mostly for budgets, selection of vendors and rarely used for strategic policy.

This study presents part of the findings of an ongoing of a doctoral research. The larger study also covers the level of perception of the benefits of benchmarking among Nigerian practitioners, the problems of benchmarking, identification of processes that require benchmarking and the framework for implementation of best practice in FM in Nigeria which entails the identification of appropriate key performance indicators, appropriate database selection; critical success factors not captured in this paper. Also an additional 14 interviews will be analysed. The final framework for implementing benchmarking will be validated with expert workshop with FM executives.

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Training Needs Assessment in Iraqi Construction Companies

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Abstract

This paper reviews the literature on training needs assessment (TNA), with the intention of organising conceptually the various methods. This paper aims to investigate the extent to which participating organisations have carried out needs assessment. The four areas that will be examined include: first, the number of companies that do formal needs assessment and the frequencies of assessing these needs. Second, the indicators in determining of training needs; third, the levels of needs assessment; and fourth, methods used in assessing training needs. A Survey data was obtained from 219 from the Project leader engineers, Site managers, Civil Engineers and Architect engineer's. Training needs assessments in the construction companies are found to be generally performed informally through questioner, performance appraisal and group meeting. Size of companies had an effect on the way training needs is being assessed and analysed. The absence of needs assessment and analysis is due to lack of expertise and it is irrespective of the size of companies and lack of top management support . The results of this study were obtained from construction Engineering perspective. This study contributes to recognize the importance and power of effective needs assessments for construction companies in helping them to plan for effective training program. Most of the studies on training are researched in Western countries. Limited empirical evidence can be obtained in Iraq, particularly from the construction industry. This study presents a comprehensive empirical survey on training need assessment in construction companies in Iraq.

Keywords

TNA, Technique and Methods

1.0 Introduction

Training need analysis is a vital element of operations in the construction industry, and identified as one of the most effective vehicles for learning which in-turn will contribute to quality and performance improvements of employee's skills in their job. It has been recognized that TNA is one of the strategic issues facing the construction sector. In order to ensure a comprehensive treatment of the issue it is important that construction companies do a diligent job of identifying TNA of their employees by designing effective training and development programs and activities, the first step in the instructional design process is the most crucial process in which it has to be properly and correctly conducted. Indeed, improperly and incorrect training needs assessments can lead to disastrous effects.

The construction sector is one of the most dynamic sectors in the Iraq economy, with upstream and downstream economic links. The sector has been growing rapidly since the 2003. Upstream economic links include industries such as tourism, energy, oil,

etc. These industries require the services of the construction industry for the execution of infrastructure projects such as roads, airports and ports. On the other hand, downstream links include industries such as building materials, cement and steel, which have seen a rise in the demand for their output in line with the expansion of building and construction activities. The contribution of the construction industry to Iraqi GDP has almost more than doubled from since 2003 represented 4.8% of the GDP while in 2000 was represented only 0.2 of the GDP (PADCO, 2006; Marzouk, 2009) . It is therefore, Iraq Government's put more emphasis in improving organisation performance in construction sector and this because the contribution of this sector significantly towards the country's economic growth (Alshawi & Alkinani, 2011; USAID, 2006). As a result, the development of human resources in the construction sector is recognised as a crucial and important task, which is vital in preparing a capable and skilled workforce with the expertise to meet current and future challenges by providing them with technological skills and critical thinking abilities. Accordingly, this paper investigates to what extent the participating companies analysed their needs and objectives and planned development. There are five areas that will be examined in this paper: first the number of companies that analysed the needs of T&D and the frequencies of analysing these needs, and secondly a barrier to the training needs assessment. Third, the levels of analysing needs; and fourth the method used in determining these needs of T&D.

2.0 Training Needs Assessment

Apparently, the availability of academic literature on TNA is limited. But, there are a number of case studies report how specific organizations or industries have conducted these assessments (Cekada, 2011). Today, more and more companies are interested in intangible assets and human capital as a way to gain competitive advantage. Training and development can help in supporting company's competitiveness by increasing the company's value through contributing to its intangible assets. However, in designing effective training and development programs and activities, the first step in the instructional design process is the most crucial process in which it has to be properly and correctly conducted. Indeed, improperly and incorrect training needs assessments can lead to disastrous effects. Anderson (2000) gives a clear explanation of needs assessment which is "*the starting point in the training process*". It is the stage in which an organization's needs could be identified, creating the foundation of an effective training effort. A needs assessment can be tailored to organisations to determine what kind of training programmes are needed for its employees, who needs to be included and under what conditions the training will occur (Ghufli, 2012; Van Eerde, et al, 2008). Brown (2002) defined training needs assessment as an on-going process of gathering data to determine which training needs exist so that training can be developed to help the organisation accomplish its objectives. The identification of training needs could help to understand the gap between what is happening in an organization and what must happen in terms of employees' behaviour, which is influenced by their knowledge, skills and attitudes (see, e.g. Al-Khayyam, 1998; Azizi *et al* ,2010 CITB 2000; Hassan *et al* 2004; Marzouk, 2009; Goulding & Alshawi 2004). In other words, training needs exist when an employee lacks the knowledge or skills to perform an assigned task satisfactorily. TNA has become the concern of every proactive manager who uses it for developing and implementing varied practical solutions for individuals, work groups, and organisations (Gupta et al., 2007; Noe, 2001; Patton, 2002).

3.0 Barriers to TNA in Arab organisation

A number of studies have found that not enough studies into training, especially regarding TNA, have been conducted. In addition, these studies have revealed that most of the TNA technique is conducted abroad. For instance, the studies of Malaysian companies by Haslinda (2009) suggest that the main reasons for this are cultural and national differences among west and south Asians regarding TNA practices (Poon and Rozhan, 2000; Rossilah and Md.Som ,2007; Arthur et al. 2003). The researcher, Agnaia (1996), investigated another Arabic country reported that the major TNA techniques adopted by Libyan companies is the performance appraisals system, which is also often considered the most common and widely used method in TNA management. The studies reveal that TNA in most Arabic companies could be described as being highly deficient (Altarawneh, 2005). Other previous researches revealed that there are no specific or systematic practices or procedures for determining training and educational needs due to the lack of reliable information, turbulent political and economic situations and fast changing social environments (Abdalla and Al-Homoud 1995; Al- Khayyat, 1998). Other Arab researchers see, (e.g. Altarawneh, 2010; Altarawneh 2009; Al- Khayyat, 1998; Atiyya, 1993; Agnaia (1996) argues that assessing the needs of employees in Arab organisations is ill-defined and generalised rather than systematic. They said this unsystematic training approach arises for two reasons: training programmes are not based on identified needs which lead to difficulties in evaluating these programmes; economic, political and social factors provide some constraints on these programmes. Arab organisations rely on different sources to get the information required to determine training needs, mainly from supervisors or trainees themselves (self-assessment), but fewer regarding task or job requirements, description and manpower planning (Duna 1991; Altarawneh, 2005). A recent study by Altarawneh, (2010) found that in Arab organisations communication does not include employees when they are selected to be trained. TNA is subject to the views, assessment, experiences and therefore perceptions, of managers and supervisors. As a result, training programmes may be the opposite of employees' expectations and fail to meet their needs. Furthermore Altarawneh (2005), in her major study of training development at Jordanian bank, argues that assessing training needs using management performance records may not reflect the actual situation. This is because these assessments are subject to family, nepotism, kinship and personal relationships between the supervisors and employees Abdalla, et al, 1998). Moreover, TNA in most Arab organisations is considered as a stand-alone process (Altarawneh, 2009). Altarawneh (2005) also argues that bureaucratic policies and patronage play more important roles. As a result of these influences few employees are selected on the basis of greatest need; bureaucratic policies and patronage play more important roles. Agnaia (1996). Several research studies by (Al-Ali, 1999; Attiyah, 1993; Abdalla and Al-Homoud, 1995; Agnaia, 1996) have identified the problems that affect implementing training needs assessment in Arabic countries. These barriers include:

- Lack of money
- Lack of expertise
- Lack of job descriptions
- Unsystematic training approaches
- Lack of employees' interest in any developing programmes
- Lack of management support
- Wasting of time

Detailed attention should be given to TNA in Arab organisations, this will help to determine the gap between what is happening and what is supposed to happen, in order to maximize organisational performance. TNA is crucially important and should be conducted based on a systematic needs analysis, including organisational needs analysis, job needs analysis and employees' and managers' needs analyses in order to design a successful and comprehensive TNA programme

4.0 Training needs assessment Methods

In terms of the methods used in achieving the determination of needs within an organisation, Jamil (2006) defined methods as *“the instruments that analysts can use to collect data for TNA purposes and they include methods such as questionnaires, interviews, group discussion methods, observation, etc”*. He also defined techniques *“as the procedures to which TNA can be conducted and the analysts may need to adopt some of TNA methods to carry out the techniques”*. Overall, Jamil (2006) divides TNA methods into two broad categories based on the types of data they produce - quantitative data and qualitative data. He suggests that quantitative data refers to the importance of something. In the case of a quantitative method lacking a particular SKA, the methods which will be used to provide the missing data will be questionnaires and numerical/ quantifiable tests. Jamil (2006) believes that these methods can only be suitable when data needs to be collected from a large percentage of the population. On the other hand the qualitative method highlights the primary definition of something. Methods used include focus groups, on-site observations and reviews of literature or records. Jamil (2006) suggests that these methods are best used when the analysts need to explore in detail the data they discovered quantitatively. Needs analysts should have good communication skills, empathetic listening skills and good interpersonal skills. They should also have the ability to observe objectively and subjectively, so that qualitative data gathering methods can be used effectively (Chiu, et al, 1999; Goldstein and Ford, 2002). As shown below, there are advantages as well as disadvantages to each of these methods so it is best to use more than one method in the TNA process in order to produce the most successful and reliable results (Wagonhurst, 2002; Jamil, 2006). Table 2 outlines the different methods that can be used. Some of these methods can be applied in the case of construction workforces.

Table 2.1 TNA methods

Methods	Explanation
1-Delphi Method	Delphi is a group discussion method which allows communication between participants who are distanced from each other. Basically, the method is based on an understanding of the concept of group dynamics. Firstly, it is recognised that each participant does not have the same information. This generates the need to make decisions as a group in order to produce better decisions. Secondly, some members may not have been encouraged to offer their opinions and may feel uncomfortable in doing so, especially to those members of the group in higher level positions. In order to address these needs the Delphi method was created. The use of Delphi in TNA is recommended as one of the tools to analyse training needs.

2- Questionnaires	Questionnaires are the most widely used method of data gathering for needs assessment. They are the most economical as they can be quickly distributed among a large group and are also relatively simple to administer, straightforward and easy to analyse.
3-On-site Observations	On-site observations methods are used to distinguish between effective and ineffective behaviour and organizational structures and processes. They are also a common way of conducting job analyses. Observations must be carried out by subject-matter experts (SMEs) if the data they yield is to be useful. One criterion for selecting SMEs is that they need to be experienced and knowledgeable about the job they observe (Jamil, 2006). Brief educational visit lasting a day or at most two to provide freehand information of objects and people being studied which would never occur in classrooms or conference rooms, to summarize and consolidate initially presented by some traditional methods as well as to provide new information This method is only useful if the job is observable and measurable and can be analysed in terms of which SKAs are required to perform the job effectively.
4-Advisory Committee	This is another form of group decision creating technique which involves employees at different levels in organizations who have information regarding an issue. The advantages of this method are that it builds management involvement and sponsorship in the TNA process, it is inexpensive to carry out and it involves key decision makers, thusmaking the task of implementing the results easier (McCoy, 1993). However, this method is time consuming, and it is sometimes difficult to organize meetings involving all the members, as there is a tendency towards ‘groupthink’ syndrome in the group decision making.
5-Document Reviews / Examinations	As stated earlier, there are many readily available documents which can provide data for TNA exercises. Examples of these include those that give information on employees’ productivity, absence rate, organizational charts etc. The advantages of the available data are that they can provide objective evidence regarding performance problems and analysts do not have to spend too many resources in gathering them. However, existing data must be treated with caution. They tend to be incomplete and do not show the background and causes of the problems, are usually quite old and skilled data analysts are needed in order to examine and make sense of the data in the context of TNA.
6-Focus Groups	This method involves small groups discussing issues or problems to produce new ideas, solutions, and proposals. The use of focus groups has become popular in the marketing profession because it is useful for gathering information on customer behaviour (McCullough, 2011). Focus groups are also useful for assessing training needs when used in conjunction with other data-gathering methods. This is regarded as the most effective method for teaching problem solving and decision-making skills. As such, it is probably

	more useful for management than staff level training.
7-Performance Appraisal Forms	This is the most common method to determine training needs based on performance appraisal and is also the most widely used method in determining training needs (Brown, 2002; and Agnaia, 1996). Usually, at the end of an appraisal form, a space is provided for supervisors to state the strengths and weaknesses of the appraised employee and recommend areas that the employee needs to improve on and develop. This method is also considered to be one of the most complex and controversial techniques in the human resource field (Roberts, 2002).
8-Assessment Centres	After employees' selection and promotion, assessment centres are widely used to determine employees' training needs (Beck, 1983). Assessment centres involve the use of various combinations of measures to identify training needs. Examples of measures that can be used are psychometric inventories, interviews, observed performance on simulated tasks, written tests, peer ratings, role plays, in-basket exercises, business games and presentations (Osborne, 1996; and Beck, 1983). Due to the variety of exercises and multiplicity of assessors the results of assessment centres tend to produce specific, reliable and valid information regarding employees' strengths and weaknesses. This allows the most suitable training needs for the employees to be determined. However, assessment centres may not be practical for all organizations as they can be quite expensive. They may only be suitable for large and well established organizations that can afford such complicated and comprehensive training systems. Thus, this method is normally used only for senior-level employees.
9-Project-based programme	Incorporates formal and on-the-job training. Like action learning, learning is focused on a clearly identified and specific problem common to a carefully selected member of organizations. A short seminar to provide formal tuition on specific topics and instructions on key issues. This is followed by a visit from the trainer to organizations of participating managers to set up a project related to the subject matter.
10- Problem oriented Exercises and Projects	The instructor giving as complete information as is needed to work on the problem under study writes up often exercises and projects. The material is distributed to the trainees in advance. The trainees are divided into groups and work separately on the problem. In the final session the groups present their reports, followed by more general discussion on the issues in hand.

Adopt by Jamil (2006)

5.0 Techniques used in conducting training need assessment

As mentioned previously, techniques refer to the procedures in which the activity can be conducted. Discussions of these techniques are categorized according to three levels. Each technique is designed to analyse needs at organizational level, operational level and individual level. These techniques are described as follows:

5.1 Organizational Level

These techniques are developed to measure the overall effectiveness of business performance and to help companies plan their strategies and missions, which may include the need to enhance their human resource capabilities (Jamil & Som, 2007).

- *Organizational Scanning*
- *Balanced Scorecard*
- *(SWOT) Analysis*
- *PEST Analysis*

5.2 Task Level

Several techniques are available to determine the SKAs involved in a particular job. A task analysis identifies the nature of the tasks to be performed on the job and the knowledge, skills and abilities (KSAs) needed to perform these tasks (Ghufli, 2011).

- *Job Analysis*
- *Competency Analysis*
- *Skills Inventory*
- *Managerial skills*

5.3 Person Level

Person analysis focuses on identifying who should be trained and which training is needed by individuals:

- *Performance Review / Appraisal*
- *Repertory Grid Analysis*
- *Versatility Chart / Analysis*
- *Diary Analysis*

Majority of previous researches revealed that there is no single organization in private sector which used all the three approaches of TNA or comprehensive TNA techniques simultaneously, conducting for assessing their manager training needs. Now, the study objectives are to find out the type of manager TNA approach organizations in Iraq, Not surprisingly, no single organizations in the two sectors are using all the three approaches simultaneously for conducting their manager TNA. Its mean any call for training that is undertaken without a watchful analysis of whether it is needed, or not required, is probable ineffective and a waste of money and resources of the organization.

6.0 Methodology and Data Resources

The descriptive analytical methodology and field of study were used in this research. The descriptive methodology was the main used methodology. This study involves the use of quantitative data collection. First, research data were collected through questionnaire surveys distributed to engineering practitioners in 12 construction companies in Iraq (large, Medium and small company) and in this paper researcher have selected only large and small company which is 8 companies. Working with quantitative methods provides the researcher with a powerful tool; answers are likely to be precise, measurable and easy to understand. The means of communication was through emails, and web survey. The data were collected through the following resources:

1. Books and references.

2. Periodicals, papers and master thesis.
3. Internet.
4. Likert scale was used for the degree of acceptance starting from strongly disagree, disagree, neutral, agree and ending by strongly agree and also not important, somehow important, not sure, important and very important.
5. Interviews with experts, academics and professionals to enrich the research results.
6. Questionnaire distribution.

6.1 Questionnaire Design

The questionnaire was formatted through the following steps:

- a. Primary design was prepared in light of knowledge published in literature
- b. External experts and specialists judgment.
- c. Pilot study.
- d. Modifications according to pilot study.

6.2 Pilot Study

A pilot study questionnaire was launched to test the skills and knowledge needs for engineering workforces and to provide information for the development of the main research questionnaire. Pilot samples of 7 contractors, academic researcher at university were chosen and the results showed that all questions are clear, accurate and well understood.

6.3 Statistical Tools Used in the Research

- Alpha (Cronbach).
- Frequencies, percentages, means and standard deviation.
- One way ANOVA.
- Independent T.test

6.4 Questionnaire Reliability

Reliability is tested by using Cronbach Alpha factor; - one of the most popular reliability statistics in use today (Cronbach, 1951). Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability: table (8) illustrates that the value of Cronbach Alpha factor for the whole questionnaire- 69 questions - was 0.70, that means all items are reliable according to the range of Cronbach's coefficient alpha; value between 0.0 and + 1.0 is reliable (Journal of Extension). Therefore, it can be said that the researcher proved that the questionnaire was reliable

Reliability Statistics	
Cronbach's Alpha	N of Items
.753	69

7.0 Analysis and Discussion

7.1 Provision and Frequencies of Needs Assessments and Analysis

Practitioners of construction engineering in large and small companies were asked if their company assess employee's training needs. The results of the analyses showed

that large companies give attention to TNA more than small companies. Within large companies, according to respondents, TNA is conducted every one year by (53%) for construction workforce and 11.2% of conducted every 2 years. These figures show that large companies have an interest in conducting a training needs assessment for their employees to keep their skills and knowledge up to date. For small companies the picture is different. It can be seen that respondents from small companies indicated that 56 % conducted needs assessment on their employees in every 2 years, and 42. % every 3 years conducted needs assessment.

Accordingly, it can be said that especially large , analysing needs is not considered an important matter. This finding is supported by other researchers into T&D in SMCs (Kerr & McDougall, 1999; Sadler-Smith, et al., 1998; Vinten, 2000; Hill & Stewart, 2000). For on the basis that most construction companies in Iraq were not systematic in their analyses of T&D needs, therefore, it may be that employees are not efficiently trained and that development attempts and training were *on an ad-hoc basis*: this suggests a fairly low level of maturity on the road from performance driven T&D to a more strategically developed HRD. Previous studies have shown that many institutions do not analyse needs at the required rate (Sadler-Smith et al., 1998; Smith, 1999; Bhatta, 2002; Budhwar et al., 2002).

Table 7.1: Frequency distribution for frequencies of T&D needs assessment by Company size

Company size	1- Every 3 years	2 – Every 2 years	3- Every one year	4- Ad-hoc	Total
Large company	0% 0	11.2% 7	53.2% 33	35.48% 22	62
Small company	42.4% 31	56.1% 41	0 0	0% 0	73

7.2 Descriptive data for Barriers to training needs

This table shows that the maximum and minimum mean for each variable (barriers to training needs). The mean for each group for each question is greater than 3 (>3). In other words, the frequency of the answers strongly agree and agree is higher than the frequency of the answers strongly disagree and disagree. However, the mean for the variable for lack of new workers interested in a skills development programme is less than 3(< 3), which means that the frequency of the answers strongly agree and agree is lower than the frequency of the answers strongly disagree and disagree. It obvious from the table below that the mean of lack of funding and management support considered the main barriers to small company, while for large company main barrier was considered by employees such as lack of adequate expertise and lack job descriptions.

7.2.1 Analysis of Variance for Barriers to Training Needs assessment

The table below shows the output of the ANOVA analysis and whether there is a statistically significant difference between companies means The analysis, conducted at the 0.5 level, revealed that two factors which form barriers to training needs assessment, such as lack of adequate expertise and lack of employees interest in a skills development programme, had an observed P value which exceeded the level

0.5. However, for the rest of the factors we observed that the significance level of training needs barriers is below 0.05. Therefore, there is a statistically significant difference in the mean of these variables of training needs barriers, between the large and small companies.

Table 7.2 Descriptive data for Barriers to training needs

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
						Lower Bound	Upper Bound
1-Lack of financial resources;	Large company	62	3.6129	.61016	.07749	3.4580	3.7679
	Small company	73	4.6986	.59360	.06948	4.5601	4.8371
	Total	135	4.2000	.80854	.06959	4.0624	4.3376
2-Lack of adequate expertise	Large company	62	4.5968	.58561	.07437	4.4481	4.7455
	Small company	73	4.1096	.59071	.06914	3.9718	4.2474
	Total	135	4.3333	.63481	.05464	4.2253	4.4414
3-lack job descriptions	Large company	62	4.7097	.52439	.06660	4.5765	4.8428
	Small company	73	4.3288	.62483	.07313	4.1830	4.4746
	Total	135	4.5037	.60931	.05244	4.4000	4.6074
4-Unsystematic training approaches	Large company	62	3.9355	.97293	.12356	3.6884	4.1826
	Small company	73	3.6438	.65341	.07648	3.4914	3.7963
	Total	135	3.7778	.82559	.07106	3.6372	3.9183
5-Lack of support from top management	Large company	62	4.2903	.68681	.08722	4.1159	4.4647
	Small company	73	4.8356	.40871	.04784	4.7403	4.9310
	Total	135	4.5852	.61554	.05298	4.4804	4.6900
6-Lack of new workers interested in skills development programs;	Large company	62	2.7097	.63729	.08094	2.5478	2.8715
	Small company	73	2.8219	.76997	.09012	2.6423	3.0016
	Total	135	2.7704	.71174	.06126	2.6492	2.8915
7-wasting of times	Large company	62	3.5484	.89950	.11424	3.3200	3.7768
	Small company	73	3.1644	.81673	.09559	2.9738	3.3549
	Total	135	3.3407	.87386	.07521	3.1920	3.4895

Table 7.2.1: Analysis of Variance for Barriers to Training Needs

ANOVA						
			Sum of Squares	df	Mean Square	F
1-Lack of	Between Groups		39.520	1	39.520	109.32
						Sig.
						.000

financial resources;					3	
	Within Groups	48.080	133	.362		
	Total	87.600	134			
2-Lack of adequate expertise	Between Groups	7.957	1	7.957	22.986	.000
	Within Groups	46.043	133	.346		
	Total	54.000	134			
3-lack job descriptions	Between Groups	4.864	1	4.864	14.414	.000
	Within Groups	44.884	133	.337		
	Total	49.748	134			
4-Unsystematic training approaches	Between Groups	2.852	1	2.852	4.286	.040
	Within Groups	88.482	133	.665		
	Total	91.333	134			
5-Lack of support from top management	Between Groups	9.969	1	9.969	32.495	.000
	Within Groups	40.802	133	.307		
	Total	50.770	134			
6-Lack of new workers interested in skills development programs;	Between Groups	.422	1	.422	.833	.363
	Within Groups	67.459	133	.507		
	Total	67.881	134			
7-wasting of time	Between Groups	4.944	1	4.944	6.752	.010
	Within Groups	97.382	133	.732		
	Total	102.326	134			

7.3 Level of TNA

The study measured the level of TNA undertaken in the organization prior to decisions made on training based on the OTP model presented by McGhee and Thayer in 1961. Eerde et al. (2008) used this scale for measuring the TNA comprehensiveness. We used this scale from jamil (2006) study in Malaysian companies on 5-point likert response scale ranging from '1 = Never' to '5 = Always' to assess the more frequent techniques of TNA adopting by Iraqi construction companies on each of the three levels. It is observed generally that the respondents perceive that their organizations are not paying much attention to all level of TNA. However, it can be seen that attention has only been paid to organization level analysis. Compared to the other techniques to analyse training needs at organizational level, PEST analysis was the most widely used by the organizations by 11.3% frequently used. The respondents from all companies have a perception that the organization is not paying much attention toward all level of analysis.it was only 39% responded said that the organization never adopt this SWOT analysis techniques for conducting training needs. 19 % employees responded said that the organization also not involved for conducting the workforces TNA through PEST analysis techniques. This ratio mention that the construction organizations in Iraq sometimes involve in preparing training program for their employee due to changes in political and

economic situation of Iraq , but contrary to fact, this method is not so common. Majority of respondents using this technique actually came from large companies responds, because large organizations have enough resources in term of finance and human assets which support them to conduct comprehensives workforce TNA techniques before conducting training program. The data analysis reveal that majority responds focused on organisational level (11.3% frequent and 38.9% seldom) assess construction workforces TNA through (PEST Level), and second majority of the organization also focuses on to conduct TNA at task level job analysis (frequent 8.3%. and 16.3%) and rarely responds focused on individual level . These figures give us an explanation that no single organization in private as well as in public sector used the organization analysis techniques, frequently or always. And more astonishingly that it appears construction organization in Iraq did not involve or give attention in three levels TNA or comprehensiveness TNA practices before conducting training program which is actually recommended by literature for better outcomes of training. As is shown in table 3, which examines the significant differences related to size of companies, the level technique of TNA used by the small companies significantly differs from that adopted by large one ($p = .000$).

Table 7.3 Frequency distribution and Test of Independency for the Levels of Determining Needs

Organisational level	1. Never	2.Rare	3.Seldom	4.Frequent	5.always	Total	Average Rating	t-test	
								T	P
1-SWOT analysis	39.33%	48.12%	10.88%	1.67%	0%	239	1.75	10.587	.000
	94	115	26	4	0				
2-organizational scanning	31.38%	48.54%	16.32%	3.77%	0%	239	1.92	10.606	.000
	75	116	39	9	0				
3-balanced scorecard	47.28%	44.77%	7.53%	0.42%	0%	239	1.61	8.298	.000
	113	107	18	1	0				
4-PEST analysis	19.67%	30.13%	38.91%	11.30%	0%	239	2.42	12.100	.000
	47	72	93	27	0				
Task level	1. Never	2.Rare	3.Seldom	4.Frequent	5.Always	Total	Average Rating		
1-Job Analysis	33.05%	47.28%	16.32%	3.35%	0%	239	1.90	13.324	.000
	79	113	39	8	0				
2-competency analysis	59.83%	29.29%	10.04%	0.84%	0%	239	1.52	9.618	.000
	143	70	24	2	0				
3-managerial skills audit	80.75%	13.39%	5.44%	0%	0.42%	239	1.26	5.921	.000
	193	32	13	0	1				
4-skills inventory	84.52%	12.55%	2.93%	0%	0%	239	1.18	5.687	.000
	202	30	7	0	0				
Individual level	1-Never	2-Rare	3-Seldom	4-Frequent	5-Always	Total	Average Rating		
1-performance review / appraisal	48.12%	43.93%	0%	0%	0%	239	1.60	12.503	.000
	115	105	0	0	0				
2-Repertory Grid	82.01%	16.74%	0%	0%	0%	239	1.19	5.778	.000

Analysis	196	40	0	0	0				
3-versatility chart / analysis	90.79%	9.21%	0%	0%	0%	239	1.09	5.637	.000
	217	22	0	0	0				
4- diary Analysis	92.89%	7.11%	0%	0%	0%	239	1.07	3.900	.000
	222	17	0	0	0				

N. never. R, rarely. S, seldom .F frequently .A ,always

7.4 Methods Used in determining Needs of T&D

There a number of methods are recommended to determine the needs of T&D in a company. Reid & Barrington (2005) suggest that methods of determination depend on what is being focused on in the research. In this study, the various methods used in determining TNA were classified into ten prefer methods of needs determination (see Jamil, 2006; Albahussain, 2000). This was to simplify the interpretation of the various needs identification methods.

The findings show that Large and LMCs both rely first on site observation (Mean 4.25) and seconly on focus group (Mean 3.75) and talking to employees about their training needs (primary information) Questionnaires (mean 3.66) are regarded as the preferred method for conducting TNA for large, and small companies, more than other methods to determine training needs as is shown in table (5.5) below. In this study, site observation and focus group are widely used by practitioners of T&D in construction companies as well as Questionaries' method employees and heads of departments about their requirements related to training needs, which were sometimes considered by employers if they were relevant to the needs of (Budhwar et al., 2002).However, the significant differences related to size of companies, the approach used by the large and small significantly differ from each other. As we can see from table 5.5 the p value is below 0.05, except for Delphi Method and Assessment centre. For the rest factors the p value is greater than 0.05. In other words there is significant difference between the large and small companies in these methods of conducting TNA.

Table 7.4 Comparing Means, Frequency Distributions and the Independent Sample T-Test of in Defining prefer methods

	1-Strongly disagree	2-Disagree	3-Nuetral	4-Agree	5-Stro ngly agree	Total	Average Rating	T	P
1- Delphi Method	1.26%	9.62%	64.02%	23.43%	1.67%	239	3.15	-4.373	.000
	3	23	153	56	4				
2- Problem oriented Exercises and Projects	1.67%	12.55%	54.39%	29.29%	2.09%	239	3.18	-2.090	.039
	4	30	130	70	5				
3- Performance Appraisal Forms	0.84%	24.27%	58.16%	16.74%	0%	239	2.91	-4.354	.000
	2	58	139	40	0				
4-Questionnaires	0.42%	10.46%	28.45%	44.35%	16.32 %	239	3.66	-1.949	.054

	1	25	68	106	39				
5-Advisory Committee	7.11%	61.92%	27.20%	2.51%	1.26%	239	2.29	.056	.955
	17	148	65	6	3				
6-Project-based programme	2.93%	41.42%	48.95%	6.69%	0%	239	2.59	-3.158	.002
	7	99	117	16	0				
7-Document Reviews / Examinations	3.35%	44.35%	42.26%	10.04%	0%	239	2.59	-1.759	.080
	8	106	101	24	0				
8-Focus Groups	0%	2.09%	32.64%	51.46%	13.81 %	239	3.77	-3.516	.001
	0	5	78	123	33				
9-On-site visit Observations	0%	1.26%	11.30%	48.54%	38.91 %	239	4.25	-3.516	.001
	0	3	27	116	93				
10- Assessment Centres	2.09%	28.45%	57.32%	11.30%	0.84%	239	2.80	-2.146	.003
	5	68	137	27	2				

8. Conclusion and recommendations:

The results of this study offer some dissimilar findings in terms of training needs assessment in construction. The reason was Iraqi constructions only focus on conducting the organisational analysis TNA before starting training program. As a result of not engaging in comprehensive TNA approach, though the result of the training program is poor and considered a subjective nature in Iraqi Constructions Company. The finding showed that lack of complete TNA approach does not meet objectivity principles of training program. No single respondent in this study have awareness that the organization achieved the training objectivity in a real scene. Based on survey result it seems that Iraqi construction companies are not well aware of the training needs assessment and this is very common problem in most Arabic organizations always intended to achieve the subjectivity of the training instead of forcing on the objectivity of the training. Empirical studies have suggested that comprehensive TNA approach helps to lead to better result of training outcomes; because comprehensive TNA starts from micro level to macro level or TNA scanning start from organizational level and come to personal level. If the problem is not at organization level, then it is a possibility that the problem may be at operational or task level and again, if the problem is not at task level, the training manager comes up at personal level. Through this comprehensive approach, organization can properly assess the actual needs of its employees (Sherazi et, 2012).

The above result also suggests that the absence of needs assessment to Iraqi construction companies mostly is due to lack of expertise, management support , lack of funding unsystematic training approaches and it is irrespective of the size of companies. Undeniably, this result has been recognized by other research studies (see for example, Anderson, 1994; Sadler-Smith et al, 1998; Heraty & Morley, 2000; Elbadri, 2001; Budhwar, et al., 2002; Hansen, 2003; Hill & Stewart, 2000; and Hill, 2004 ;Ali ,2006).

This study may give a good direction for judging better technique and methods of TNA, especially in Iraqi circumstances. This study could explore the TNA current practices and its impact on the training outcome. In future, the study can explore the best technique and a method of TNA which is more suitable in Iraqi scenario. This study also contributes to Iraqi organisations do recognize the importance and power of effective needs assessments in helping them to assess employees needs. From previous research, it appears most of the studies on training are researched in Western countries. Limited empirical evidence can be obtained in Arabic country particularly from the Iraq. This study presents a comprehensive empirical survey training needs assessment in construction companies in Iraq and therefore the result could generalize the nature of needs assessment and analysis for employees' training, learning and development in organizations.

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Integrated Solutions based on BIM and Sensing Technologies for Construction Health and Safety Management

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Abstract

Acquisition of sensor data from the field is essential not only for ensuring reliable building operations but can also help in dynamic management of various tasks which are associated with Health and Safety (H&S). Building Information Modeling (BIM) offers a new epitome to provide comprehensive solutions for H&S and evacuation planning in confined spaces. Researchers around the globe have presented hybrid solutions for integrating different sensing technologies with BIM such as Radio Frequency Identification (RFID) tags, Ultra High Frequency (UHF) Readers and Sensors. A review and critical evaluation of literature on integrated solutions of BIM with various sensing technologies is performed in order to present a hybrid solution based on BIM and Wireless Sensors Networks (WSNs) along with a notification system for confined spaces. The application, entitled *CoSMoS*, is expected to provide a new horizon for effective visualization, reliable data capturing and catering to time sensitive emergency situations for construction H&S management. The paper will also outline scope of future research in this domain.

Keywords

Building Information Modeling (BIM), Health and Safety Management, RFID, Sensors, Technology

Introduction

In the European Union (EU), every year nearly 25 workers die and many more are seriously injured in confined spaces due to exposure to a hazardous environment (EFS, 2012). Lack of oxygen and temperature extremes contribute to make work environment hazardous in confined places (WorkSafeBC, 2008). Health and Safety Executive (HSE) has defined confined spaces as “any space which is substantially enclosed and where serious injury can occur from hazardous substances or conditions within the space or nearby (e.g. lack of oxygen)” (HSE, 2013). HSE has also defined thermal comfort in the workplaces as “an acceptable zone of thermal comfort for most people in the UK lies roughly between 13°C and 30°C”, whereas oxygen level in the confined space atmosphere should not be less than 20% by volume (HSE, 1996). The regulations on confined spaces highlighted that temperature and oxygen are two major factors that should be monitored carefully to ensure reasonable comfort level and to avoid heat stress or cold stress while working in the confined spaces.

There are various potential sensing technologies which can be used by the construction industry personnel to detect hazards on worksites. RFID tags, Global

Positioning Sensors (GPS) and environmental monitoring sensors are some of the technologies which have advantages but limitation too (Bohn, 2009). RFID technology plays an important role to increase safety at worksites (Goodrum et al, 2006). For example, it can alert the system that workers are very close to equipment and machinery on construction sites. Tracking of various objects and workers has been the main application of RFID technology focused by researchers in the last decade. But RFID is limited in sensing and positioning capabilities and does not provide cost effective solutions when there is a need of two way communications (Nikitin, et al., 2006; Kaur, et al., 2011). In order to achieve wireless communication and environmental monitoring WSNs can be examined. WSN is a promising technology, which overcomes the limitations of RFID technology, and it has contributed the concept of environmental monitoring for temperature, light and humidity etc. (Lynch, 2004). WSN technologies have been improved over time by reduced sensor cost, size and increased functionalities (Long, et al., 2010). Sensor nodes find its application in the process of operations and emergency situations in any building. Set of sensor nodes distributed in an environment reports to a wireless gateway which forms a wireless sensor network and can be configured to send alerts for avoiding H&S hazard at work sites (Kainan, et al., 2010).

Building Information Modeling (BIM) is one the emerging development in Architecture, Engineering and Construction (AEC) industries (Azhar, et al., 2008). It is a primarily three dimensional, virtual and object oriented digital representation of any building and enables to stimulate the construction buildings in virtual environment (Azhar, et al., 2012). A BIM model contains all the information which is generated as well as maintained throughout the life cycle of building. BIM-enable project delivery approach can greatly benefit planning, designing, preconstruction and post construction processes (Messner, 2009). Visualization, forensic analysis, cost estimation, facility management and collision detection are some of the purposes for which BIM can be used (Azhar, et al., 2008).

There have been substantial attempts in the integrations of BIM with RFID technology and BIM with sensing technology to provide solutions to construction industry directly or indirectly to reduce H&S hazards. A review of BIM-RFID and BIM-Sensors based integrated solutions has been presented and an application of BIM-WSN is proposed. The goal of this study is to integrate BIM with real time sensor data acquired from WSN in order to enable BIM to support the facility management phase in various buildings. The proposed application will be applicable for real time monitoring the confined spaces and avoiding the H&S hazards inside buildings or construction sites.

Research Methodology

A literature review was initially performed to collect information about the integrated solutions based on BIM and sensing technologies. As studies on the implementation of BIM-RFID or Sensor based integrated solutions have been given much attention in the past literature (briefly discussed in Table 1 and Table 2). A conceptual integrated architectural model for BIM and wireless sensing technology application has been developed from the review of previously integrated solutions. It was then later shaped into a prototype system to implement the integration approach and to demonstrate the proof of concept.

BIM and RFID Integrated Solutions

A BIM software, a BIM database, RFID tag information and software application are the main components of any BIM and RFID integrated system (Meadati, et al., 2010). This integration is only possible by Application Programming Interfaces (API) offered by BIM as well as by RFID systems. A summary of BIM-RFID integrated solutions are listed in Table 1.

Taylor, et al. (2009) discussed the importance of BIM-RFID integration by discouraging the manual material management process using flagging technique. Hajian, et al. (2009) suggested the BIM-RFID integration for project information management to increase the productivity rates of AEC industry. Motamedi, et al. (2009) showed the importance of distributed databases by using BIM-RFID technique for managers who don't have access to centralized databases in real time. Meadati, et al. (2010) used BIM-RFID integration to increase the information retrieval efficiency during the operation and management phases of a building. Components installed in a building have RFID tag on it, which helps facility manager to locate it on BIM software. After getting the exact location it's operating manuals and specifications can easily be accessed at the time of hazardous situations in buildings. Sattineni, et al. (2010) used RFID-BIM integration for tracking assets and workers in a building. It aimed to increase safety and productivity of workers on job sites and visualization is achieved using Autodesk Revit Architecture BIM based software.

Cheng, et al. (2011) applied BIM-RFID integrated approach to planning, manufacturing, construction, maintenance and recycling phases of project management. Tracking of building components is achieved and a Microsoft Access based database is maintained. Construction managers can view stored information about available resources during the entire life cycle of a building and actual quantities of components can easily be determined. This stored information can help in making calculations about the loss occurred by fire hazards in worksites. Costin, et al. (2012) used BIM-RFID integrated solution for tracking the location of RFID tagged building components by providing a management system interface to a facility manager. Motamedi, et al. (2012) provided localization methods to locate fixed as well as movable assets inside a building using RFID and BIM integration. The main advantage of this integrated technique based on localization method is it's adaptability to environment. If positions of assets are changed with time, information will automatically be updated in a database and reference points are set accordingly for locating movable assets in a building. This integrated solution can also help to track the workers in building in hazardous situations. Hence, the solutions are primarily focusing on tracking and progress monitoring.

BIM and Sensors Integrated Solutions

Alahmadi, et al. (2011) integrated BIM with Real Time Monitoring (RTM) system to monitor energy consumption in a building.

RTM consists of numerous sensors which are placed at different locations in a building for collecting energy usage data. By this integration, facility manager would be able to monitor and control the unnecessary energy consumption in different locations in a building and a wireless communication between different energy consuming devices and BIM enables remotely shut down different devices in emergency situations in a building.

Table 1: BIM and RFID Integrated Solutions

Primary Purpose	Tracked and State	Components	Location	Findings	Reference
Material Management using RFID/GPS-BIM Approach	Building components (Stationary)	material Expansion project-Outdoor	Power	Plant Achieved easy and fast material tracking process in construction phase.	Taylor, et al. (2009)
Progress monitoring and lifecycle management	HVAC components, Fire safety equipment (Movable and Stationary)	Construction building – Indoor and Outdoor	Construction	Achieved visualization of the status of a facility in Construction and Maintenance phases of a building under construction.	Motamedi, et al. (2009)
Real-time monitoring of RFID tags in BIM Model	Objects and (Movable)	People	Building-Indoor	Imported RFID data in BIM model and displayed.	Sattineni, et al. (2010)
Automated management of life cycle information of buildings	Building components (Stationary)	i.e. facilities, pipes etc.	Building-Outdoor	Generated 4-D virtual reality model, examined construction interfaces and conflicts in design phase and monitored construction installation works in real-time.	Cheng, et al. (2011)
Automated Identification	Building component Projectors (Stationary)	i.e. (Stationary)	Building-Indoor	Accessed Operations and Management (O&M) information of building components.	Meadati, et al. (2011)
Fixed localization	Assets Fire extinguisher cabinets (Stationary)		Building-Indoor	Located RFID tagged building components without RTLS Services.	Motamedi, et al.(2011)
Movable localization	Assets RFID tags (Movable)		Building-Indoor	Located movable RFID tags without RTLS Services.	Motamedi, et al.(2012)
Tracking of valuable assets in real-time	HVAC, Light Valve etc. (Stationary)	switch, (Stationary)	Building-Indoor	Maintained Database of valuable assets by tracking using passive RFID tags	Costin, et al.(2012)

Table 2: BIM and Sensors Integrated Solutions

Purpose	Type of Sensors Used		Location	Findings	Reference
Building Management	Energy	Temperature, Humidity, Light sensors	Building-Indoor	Proposed a wireless sensor network design tool to support building energy management.	Guinard, et al. (2009)
Building Monitoring	Energy	Electricity consumption sensors	Building-Indoor	Highlighted importance of BIM-based Baseline Building Model for monitoring building environments.	Woo, et al. (2011)
Real Time Energy Monitoring	Building	Voltage, Current, Power sensors	Building-Indoor	Proposed solution to reduce energy usage in a building.	Alahmadi, et al. (2011)
Crane System for blind lifts	Navigation	Laser, Load sensors	Building-Outdoor	Displayed location of a lifted object by crane in the context of a building and the surroundings using an imported BIM model where data is collected through sensors and a video camera.	Lee, et al. (2012)
Visualization of Building Performance	of Temperature, Light, Current sensors	Temperature, Humidity, motion, CO ₂	Building - Indoor	Achieved Real-time visualization of building performance data.	Attar, et al. (2012)
Optimization of Building Operations	of Temperature, Light, CO ₂ , Detection sensors	Temperature, Humidity, Presence	Building - Indoor	Monitored sensor data and identified relevant IFC objects that could support sensor data	Cahill, et al. (2012)
Post Evaluation (POE) in Residential Buildings	Occupancy (POE) in energy sensors	Temperature, Humidity, energy consumption	Building - Indoor	Monitored real-time building related energy performance	Ozturk, et al. (2012)

Woo, et al. (2011) also presented BIM-Sensor based integrated solution with XML parsing engine for monitoring electricity consumption in a building. Lee, et al. (2012) integrated BIM with sensors to develop a Tower Crane Navigation (TCN) system which provides three dimensional information of lifted object by crane and surroundings using different sensors. It will not only make easier for crane operator to work efficiently and will also increase safety at construction sites. Attar, et al. (2012) proposed the concept of sensor enabled cubicles for visualizing the building performance in terms of its physical attributes of environment. Analog outputs from different sensors has been digitized using interface board and sent to embedded computer. Web based database is maintained by collection of data received by embedded computer on a wireless channel. Front end software has been designed to use sensor data from a web database for visualization purposes. The proposed framework does not encounter user centric approach of visualization because every user which can be building occupant, facility manager or owner has its own requirements for deploying sensor network, which need to be explored. Cahill, et al. (2012) and Ozturk, et al. (2012) also highlighted the importance of sensor networks deployment in buildings for the purpose of decreasing the operational and maintenance costs of buildings. Incorporating sensors in buildings for facility management operations like monitoring energy performance will be a next step towards intelligent buildings. The summary of above discussed BIM-Sensors based integrated solutions are mentioned in Table 2.

1. Proposed BIM-WSN based Integrated Solution

A prototype system entitled *CoSMoS* (Confined Space Monitoring System) is designed to avoid H&S environmental hazards occurring in confined spaces. The requirements have been determined by reviewing the above discussed integrated solutions. Revit Architecture 2013, a BIM software solution by Autodesk is used due to the availability of Application Programming Interfaces (API) and Software Development Kit (SDK) (Autodesk, 2013). These features make the Revit Architecture a good choice to write custom software applications for the proposed system.

System architecture used for the implementation of integration of BIM with WSN is depicted in Figure 1.

Revit internal database is maintained by Revit itself which have information about all the building components which are used in designing a virtual building model. Moreover, sensors (e.g. TelosB used in this case) have their own temporary memory to hold sensor values. In order to develop a prototype system, two TelosB sensing motes and one TelosB gateway mote has been used to make a WSN in two poor ventilated rooms in a building.

TelosB is a low cost and small size mote used to monitor Temperature, Humidity and Light of an environment (Gehrke, et al., 2006). It is supported by TinyOS open source operating system developed by UC Berkeley and supports self-configuring sensor networks.

Sensor data has been stored in a human understandable format in database tables so that it can easily be interpreted by users. A self-updating Graphical User Interface (GUI) with a name *CoSMoS* has been designed as a Revit Add In (an external application), which can be invoked by pressing external tools button from Revit

Architecture software and will start updating itself with latest values of sensors as shown in Figure 2 and *CoSMoS* system flow diagrams are shown in figure 4.

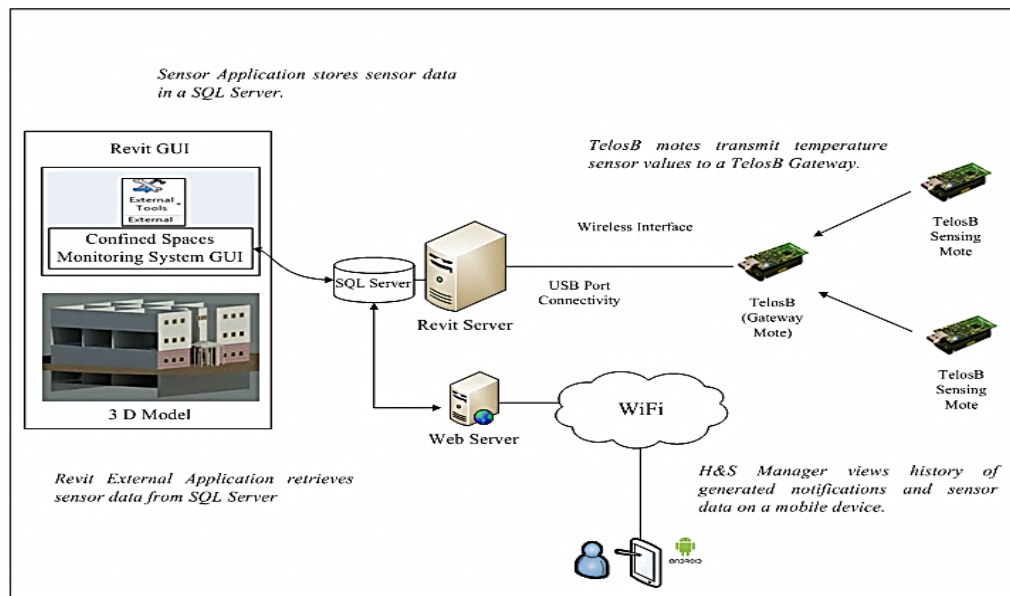


Fig. 1. BIM-WSN based Confined Space Monitoring System Architecture

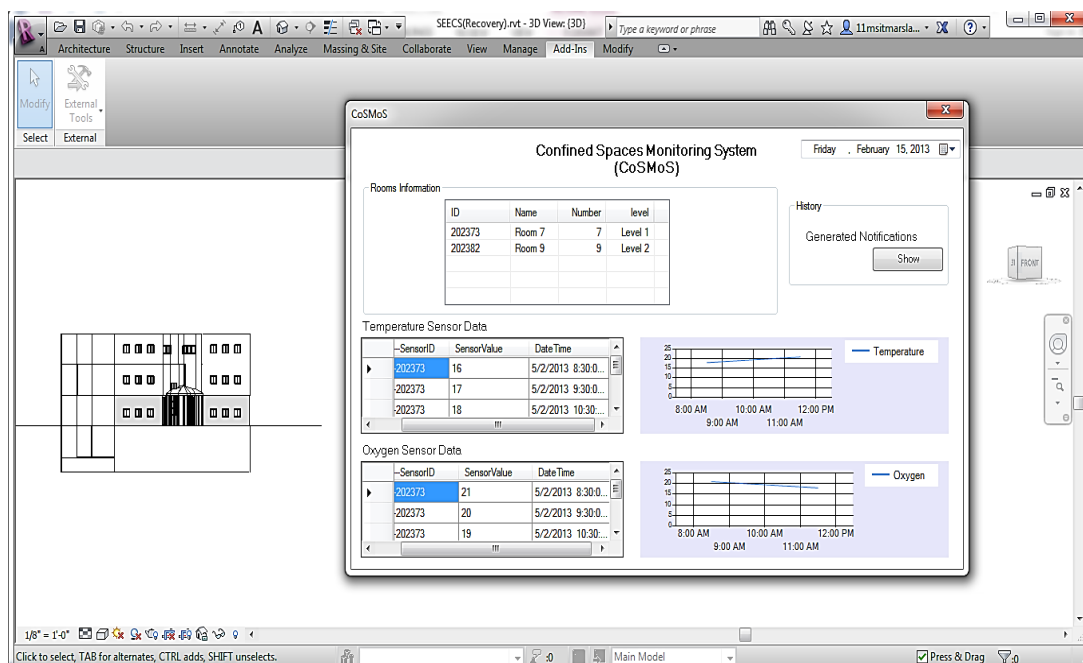


Fig. 2. Invoked External Application from Revit GUI

The main reason of designing a simplified GUI is that people from different technical backgrounds can understand it easily. Sensor application using C# language is created to read the wireless sensors placed in confined spaces with their Room IDs. Sensor application is programmed to read USB port and to provide connectivity to wireless sensor gateway. After reading the sensors data, values of temperature and oxygen are stored with Timestamps in an SQL Server database and

database is updated with latest values of sensor data after every 15 minutes. The time interval of saving a sensor data in a database can be increased or decreased by a user as required. Revit External Application with a GUI is also designed using C# language. A GUI is composed of a list which consists of all the rooms' information which is tagged by a user as confined spaces. The roof and the some walls are hidden in Fig.3 to show the confined spaces in a building. Two data grid views are added to show the sensor data of Temperature and Oxygen from their database tables.

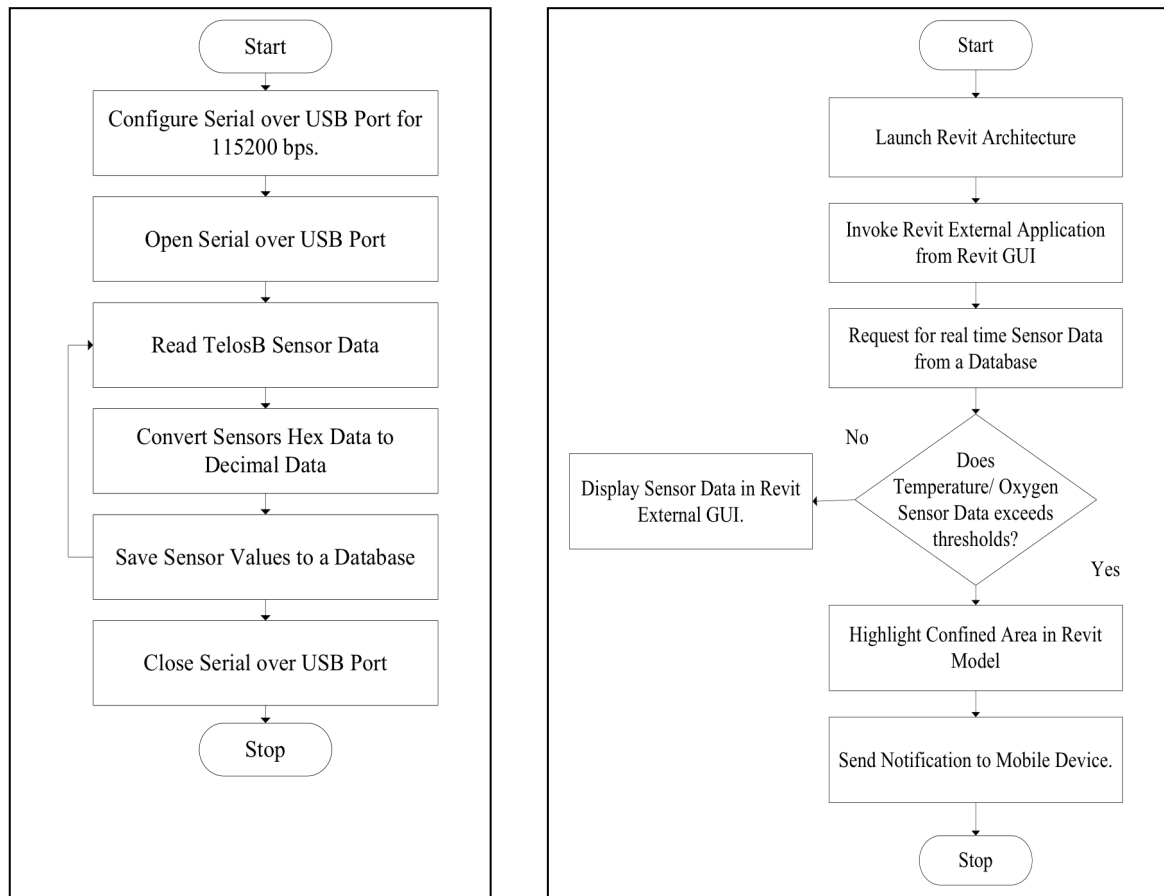


Fig. 3. Flow Diagrams of Sensor Application (left) and Revit External Application (right)

In the designed prototype, temperature data is real time and collected from TelosB motes however, Oxygen data has not been monitored in real time due to non-availability of Oxygen monitoring sensors. This GUI will help the building supervisors to actually visualize the confined spaces and observe their associated real time sensor data. If sensor data increases or decreases the defined thresholds in any physical Confined Space then a confined space will be highlighted automatically in Revit Model. Notifications will be generated in Revit Architecture and to H&S Manager's mobile device. The occurrence of notifications will be saved in a database for future accidents analysis.

Another objective of *CoSMoS* is to allow H&S Manager to remotely monitor sensor data of confined spaces located in a building using mobile devices. *CoSMoS Mobile*

Application has been designed using Android, an open source platform for mobile devices. Android platform is chosen because it provides comprehensive set of tools and frameworks to design mobile applications easily and efficiently. Moreover, this platform will command nearly half of worldwide smartphone operating system market by the end of year 2012 (Gartner, Nov. 14, 2012).

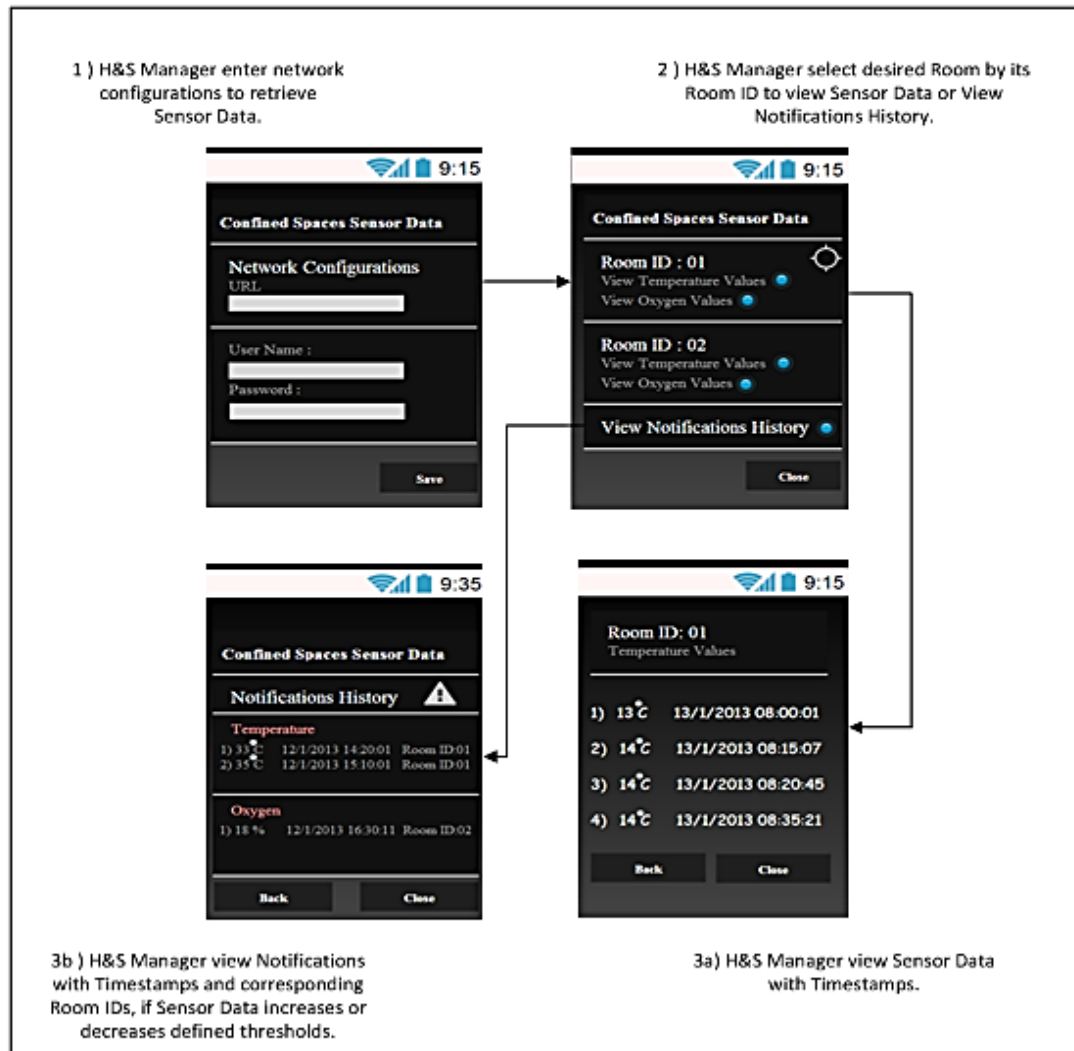


Fig. 4. Confined Spaces Monitoring Mobile application

Application is designed using Eclipse, an integrated development environment and it is tested in Android Virtual Device (AVD). Wi-Fi (standard IEEE 802.11) is used for connectivity with a web database and access to database is protected with a username and password. By using designed application, H&S Manager can easily monitor the real time sensor data of confined spaces and can able in a position to avoid time sensitive emergency situations occurring in buildings or construction sites. The screen shots taken from AVD are shown in figure 4.

Conclusion and Further Research

The developed prototype application investigates the integration of BIM with wireless sensors and mobile computing. The integration of aforementioned technologies has led to fulfill the remote monitoring the real time sensor data

requirement of H&S Managers. The designed application is at initial stage of development and incorporation of activity and other gas monitoring sensors will add more value to a designed system to reduce deaths and injuries occur in confined spaces.

After designing and development of *CoSMoS*, it needs to be evaluated in terms of effectiveness, practicality of the system, usability and financial feasibility by industry experts. There are many ways in which designed application can be improved. For example, the most important function can be added is to remotely turn off or turn on the wireless sensors from a mobile device for saving sensors' limited battery power. Another way to introduce the concept of energy efficiency in wireless sensor network is the addition of activity detection sensors. Keeping the temperature and oxygen sensors in sleep mode and as soon as activity is detected by activity sensors, the temperature and oxygen sensors will wake up and start monitoring the confined spaces. Furthermore, developed Android application can also be enhanced if it allows the H&S Manager to remotely configure sensor values thresholds and time intervals of saving sensor values in a database to avoid memory overflow. These enhancements can give a more proactive approach to deal with confined space related hazards.

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Quality Management as a Key Requirement For Stakeholders' Satisfaction In Nigerian Construction Projects

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Abstract

The increased desire for stakeholder satisfaction in Nigerian construction projects has prompted the need to deliver high performance projects and implement effective quality management protocols. Through a critical review of literature, 25 quality management attributes that influence stakeholder satisfaction with projects in the construction industry are highlighted, for example, process improvements, long range thinking, team work, etc. Following a categorization of these attributes, 10 key barriers to the implementation of quality management in the construction industry were identified and these are applicable to Nigeria also e.g. Proper project definition, project responsibility, information management, etc. On this basis an on-going research which will be beneficial to construction stakeholders sets the scene for implementing better quality management in delivering construction projects in Nigeria. The research is also beginning to identify roles that various stakeholders should have played in overcoming the barriers in the Nigerian setting such as accepting full responsibility for quality as well as formal and informal information sharing between different levels of stakeholders.

Keywords

Evaluation, Quality management, Satisfaction, Stakeholders, Success factors.

Introduction

Discussions in this article are part of an ongoing research on improving quality and customer satisfaction in Government construction projects in Rivers State of Nigeria. The article is informed by the on-going literature review and provides a platform to optimise quality management and improve stakeholder satisfaction in the Nigerian construction industry.

The subject of quality management in the Nigerian construction industry has continued to gain popularity within stakeholders in the industry. Smith *et al.* (2001) and Moza *et al.* (2012) categorised stakeholders as direct or indirect participants who have a vested interest and can make a contribution to the success of the proposed project. Traditionally, these stakeholders include Architects, Project Managers, Civil Engineers, Government regulatory bodies, Customers, amongst others (Moza et al 2012). Stakeholders are expected to perform their duties effectively and in congruence with each other to ensure project success (Moza et al 2012). According to Oluwakiyesi (2011), the Nigerian construction industry which accounts for approximately 1.4% of the country's GDP is still contending with inherent challenges such as inadequate technical expertise and poor policy

implementation. These challenges have gross effects on the quality of the finished project as well as the satisfaction of the stakeholders involved.

Over the years, efforts have been made to improve the quality of construction projects globally. For example, the introduction of Lean Construction (Ballard 2000, 2008; Yu et al 2009) to eliminate waste, reduce project duration and improve planning reliability (Alarcon, and Seguel 2002), the implementation of Total Quality Management TQM (Love et al 2004; Pheng and Teo 2004) to improve customer satisfaction and reduce construction defects (Torbica and Stroh 1999; Hoonakker 2010) and the adoption of Six Sigma (Pheng and Hui 2004; Zu et al 2008) to improve understanding of customer requirements, improve productivity and financial performance (Kwak and Anbari 2006). Although these efforts are seen as a repackaging of the various quality principles and have been highly criticised for lack of economic value (Kwak and Anbari 2006; Hendricks and Singhal 2000), their implementation has shown marked improvements in terms of performance and satisfaction in projects where they have been implemented (Zu et al 2008; Hoonakker 2010).

Whereas authors like Ahadzie *et al* (2008) and Chen *et al* (2010) argue that there is neither a consistent interpretation for project success, nor a known evaluation mechanism to measure satisfaction, Akintoye and Main (2007) and Chinyio and Olomolaiye (2010) elucidate that stakeholders in a construction project and its sub sectors all have different expectations which need to be met or exceeded.

However, research according to Ahmed (1995) and Adenikinju (2003) suggests that stakeholders' expectations in Nigerian construction projects are sparingly met or exceeded. This is chiefly due to the fact that there are under-achievements in the construction management processes, as well as the durability and sustainability of the constructed projects. Issues such as time and cost overruns, high costs in maintenance, absence of excitement factors and ultimately project abandonment are seen to occur more frequently and cloud performance in Nigeria (Aibinu and Jagboro 2002; Odusami and Iyagba 2003; Aibinu and Odeyinka 2006; Sambasvian and Soon 2007; Ipingbemi 2008). Thus, effective and efficient management of quality is suggested as a solution to meeting or exceeding such expectations despite the challenge in measuring its extent. A research seeks to address these issues and aid in stakeholder satisfaction in Nigeria regarding the finished construction project.

The next section provides an overview of quality management and proceeds to highlight 25 of its attributes that influence stakeholder satisfaction. The research then provides an evaluation that identifies 10 key barriers to the implementation of quality management and makes a conclusion on a way forward for the research.

Quality Management

Quality has constantly raised arguments, first on its definition, and secondly on its implementation (Palaneeswaran et al., 2006). While one category of scholars see quality as a way of carrying out activities to required standards and eliminating waste, another see it as a characteristic of a product or service that guarantees its acceptance over competitors (Akao 2004). From a construction perspective, Barrett (2000) highlights that achieving good quality is synonymous to satisfying or fulfilling the net expectations of the project participants, who are part of the stakeholders. In this context therefore quality has been defined as the positive worth of a product or service in relation to its conformance to requirements, suitability for

use, and potential for ensuring satisfaction (Palaaneeswaran 2006; Nzekwe-Excell *et al* 2010). The act of overseeing all the actions that ensure this conformance to requirements is referred to as quality management. The BS EN ISO 9001:2008, which outlines the requirements for a quality management system, reiterates that organisations need to establish, document, implement and maintain a quality management system to enhance effectiveness and conformance to international standards (ISO 9001:2008). However there seems to be a deficiency in the establishment of a quality management system in the Nigerian construction industry, as it faces pertinent quality issues such as cost overruns, rework, high maintenance costs and project abandonment (Aibinu and Odeyinka 2006; Olalusi and Otunola 2012) and the on-going research aims at the reduction or total elimination of these downsides.

The attributes of Quality management

The quality management attributes outlined in this research address the pertinent issues surrounding the progress of construction projects and satisfaction of the stakeholders involved. These attributes were developed from the ideologies of three quality Gurus: Deming, Juran and Crosby; and are outlined in Table 1 (Powell 1995).

Table 1: Attributes of quality

Aspect	Perspective of		
	W. Deming	J.M Juran	P. Crosby
Quality Management Orientation	Technical	Process	Motivational
Quality definition	Non-faulty systems	Fitness for use	Conformance to requirements
Responsibility	Management	Management	Management
Goal	Meet/exceed customer needs	Continuous improvements	Zero defects
Implementation element	14- Point program: TQM	Juran Trilogy: quality planning, quality control and quality improvements	14-Step program

Adapted from (Powell 1995).

According to Powell (1995) W. Deming considered the technical aspect of quality and introduced Total Quality Management (TQM) as a philosophy that directs the construction processes to meet the needs of customers. J. M Juran and P. Crosby on the other hand, sought to employ the use of management to measure and monitor continuous improvements in the construction processes to ensure zero defects in the finished project. In relation to the Nigerian construction industry, which still has challenges in meeting the needs of the stakeholders (Adenikinju 2003) the quality management attributes that influence stakeholder satisfaction in construction projects are presented in Tables 2, 3 and 4. These 25 attributes cut across the quality management orientations of the technical, process and motivational aspects of

construction projects. A brief description of each attribute is provided in the relevant Table.

Table 2: Technical attributes of Quality Management.

Quality attribute	Brief description	Reference
1. Quality training:	Ensuring that appropriate training on quality is given to responsible stakeholders	Akao (2004).
2. Benchmarking:	Identifying and emulating best practices from construction leaders.	Love et al (2004).
3. Continuous improvements:	Focus on improving construction processes seeking incremental improvements over time or breakthrough improvements over a longer period.	Akao (2004).
4. Long range thinking:	Employing strategic thinking and projection into the future construction processes as well as the nature of the construction project in the long term.	Ahmed (1995)
5. Quality control:	Ensuring a certain acceptable level of quality in the construction project and its supply chains throughout its project life cycle.	Akao, (2004).
6. Health and Safety:	Providing a conducive and safe working environment. Attaching health and safety philosophies to the construction processes.	BSI, (2008).
7. Technical expertise:	Utilization of specialists for key aspects of construction. Also obtainable from benchmarking	Leung et al., (2008).
8. Quality standard implementation:	Ensuring the implementation of quality standards such as ISO 9001, ISO 14000 to the construction project and its supply chains.	BSI, (2008).
9. Auditing:	Ensuring accountability of personnel and materials throughout the project life cycle.	BSI (2008).

Table 3: Process Attributes of Quality Management

Quality attribute	Brief description	Reference
1. Process Improvements:	Strategic evaluation of existing construction processes to meet targets and achieve goals	(Hoonaker et al 2010).
2. Open culture:	Ease of access to information and management.	(Leung et al 2008).
3. Meeting customers' requirements:	Clear and succinct understanding of the customers' requirements and criteria for satisfaction from such requirements.	Hai et al (2012).
4. Reducing Rework:	Early detection and prevention of errors in the construction process with reduced	Ballard (2008).

	reliance on final inspection, and encouraging step by step inspection.	
5. Process design:	Ensuring continuity of construction activity through effective process design. This eliminates the conflicts arising from changes within the personnel in the cause of the construction project.	Barrett, (2000).
6. Result measurement:	Milestones to measure project progress and results of quality levels.	Phillips et al, (2008)
7. Quality assurance:	Activities involving an evaluation of the project planning, design and development, to ensure that the quality of construction is akin to the designed quality.	Phillips et al., (2008)
8. Post project review:	Knowledge management and learning at the completion of any project based on the activities carried out in the construction project.	BSI, (2008).
9. Post implementation evaluation:	Technical and business evaluation of construction projects to ascertain if the project was “fit for purpose” and “worth the spend”.	BSI, (2008).

The technical attributes of quality management entail the development of skills required for quality management implementation. These skills are not restricted to the development of the stakeholder, but also to ensure conformity to international standards and requirements in the construction project. Table 3 presents the attributes of quality management that influence stakeholder satisfaction from a process perspective.

Stakeholder satisfaction from construction projects can be influenced highly by the quality of the construction process. The processes which are usually outlined in the planning phase should be maintained throughout the project life cycle. Feedback and evaluations are essential aspects of the attributes of quality management as they enhance the management of knowledge and continuous improvements in subsequent construction projects. The motivational attributes of quality management that influence stakeholder satisfaction focus on developing individual and inter-stakeholder skills attitude and morale while carrying out construction projects (Leung et al 2008). These are presented in table 4.

Table 4: Motivational Attributes of Quality Management

Quality attribute	Brief description	Reference
1. Employee empowerment:	Reduced external influence on employee, allowing employees' exhibit expertise although with conformance to design requirements	(Leung et al 2008).
2. Executive commitment:	Executive fully dedicated to the project success, providing necessary support for	(Hoonaker et al 2010).

	employees and other stakeholders.	
3. Employee involvement:	Creating an enabling environment to allow employees participate in planning and decision making while reinstating employee responsibility for quality of project.	Zwick (2004), Phillips et al (2008)
4. Team work:	Goal focused construction processes through the use of teams to enhance both performance and job satisfaction	(Leung et al 2008).
5. Team based problem solving:	Maximising knowledge from team members to solve problems. Team members openly contribute their knowledge of the problem and its solutions, creating a platform to adopt a viable solution.	Phillips et al., (2008); Hoonaker et al., (2010).
6. Increased supplier relationships:	Establishing strong information exchange between stakeholders in the supply chains, setting quality acceptance criteria	Bemelmans, (2012).
7. Motivation:	Employing the use of rewards and bonuses for meeting quality targets.	Phillips et al., (2008).

Impact of achieving construction project quality on stakeholder satisfaction

Satisfaction, which is a psychological phenomenon that is obtained when expectations are met or exceeded is quite difficult to measure (Yang and Zhu, 2006). However, the attributes highlighted above encompass the technical, process and motivational aspects involved with construction projects and influence satisfaction even in the Nigerian industry. All stakeholders contribute to the outcome of the quality of a finished project, and this is achievable through effective planning, communication, knowledge management, training, and post project review and evaluation. Consequently, the stakeholders in a construction project are responsible for the satisfaction of other stakeholders as their independent activities, have an overall effect on the nature of the final construction project. In addition, attributes such as team based problem solving and quality standard implementation and auditing, should be seen as positive processes to optimise conformance to design requirements rather than avenues to apportion blame and reveal lapses in the construction processes. Although the Implementation of these quality attributes is a panacea for positive results in the construction industry, there are barriers which can inhibit the optimisation of quality management especially in Nigeria and these are presented below.

Barriers to Quality Management implementation in Nigerian construction projects.

The major challenges affecting the Nigerian construction industry include the shortage of technical expertise, poor implementation of policies and absence of excitement factors in project design and execution (Oluwakiyesi 2011). Indeed these challenges cut across the activities of the various stakeholders involved with construction projects in Nigeria. The implementation of quality management seeks, in part, to minimize the effect of these challenges. However, there exist some lingering barriers which need to be overcome to benefit fully from the implementation of the attributes of quality management highlighted above. The theory of Categorisation (Margolis 1994) which is interpreted as singly necessary

and jointly sufficient aided in the formation of the barriers to quality management implementation. Categories to highlight potential barriers were developed through a review of literature on the attributes of quality management. In a similar regard, Hai *et al.*'s (2012) research identified key barriers to coordination in construction projects in Malaysia, and discussed these under five headings as shown in Table 5.

Table 5: Barriers to coordination in construction projects in Malaysia.

Barrier		Features
Nature of construction		Complexity and intangible of project activity, uniqueness of low repetition, temporary construction project, labour intensity.
Construction participants		Myriad and multi-discipline, Adversarial relationships, Uncommon objectives.
Traditional contractual agreement		Fragmentation of construction processes, Uneven risk allocations, Lowest bid winner, Multi-layer subcontracting.
Organisational characteristics		Temporary organisation, project based arrangement.
Construction management approach		Informality.

Source: Hai et al (2012).

According to Hai *et al* (2012), coordination, a management principle which offers optimum cooperation between stakeholders plays a vital role in the design and construction phases of construction projects. Identifying key barriers to coordination in construction projects aided stakeholders to optimize the advantages of innovative management systems such as Partnering, Supply Chain Management and Enterprise Resource Management (ERP). In more advanced countries such as Canada, Jergas and Van der Put (2001), add that the use of innovative construction methods and advanced computer technology were a major barrier to obtaining the benefits of constructability on construction projects of which stakeholder satisfaction in a part of. Although there exist similarities between the nature of construction projects in Nigeria and Malaysia as both are developing economies, identification of the key barriers to the implementation of quality management is essential to optimise the advantages of quality management implementation. The knowledge of these barriers enables stakeholders to develop strategies to improve project performance and reduce or eliminate the challenges facing the Nigerian construction industry.

Figure 1 presents the major barriers to the implementation of quality management in the Nigerian construction industry. These 10 key barriers which are explained below were generated from a review of literature on the quality of Nigerian construction projects. In addition, a comparison of the similarities in the barriers to quality management implementation through categorisation aided in the generation of these key barriers. However, barriers which could influence stakeholder satisfaction in a broader geographical scope are also highlighted as they could be related to Nigeria.

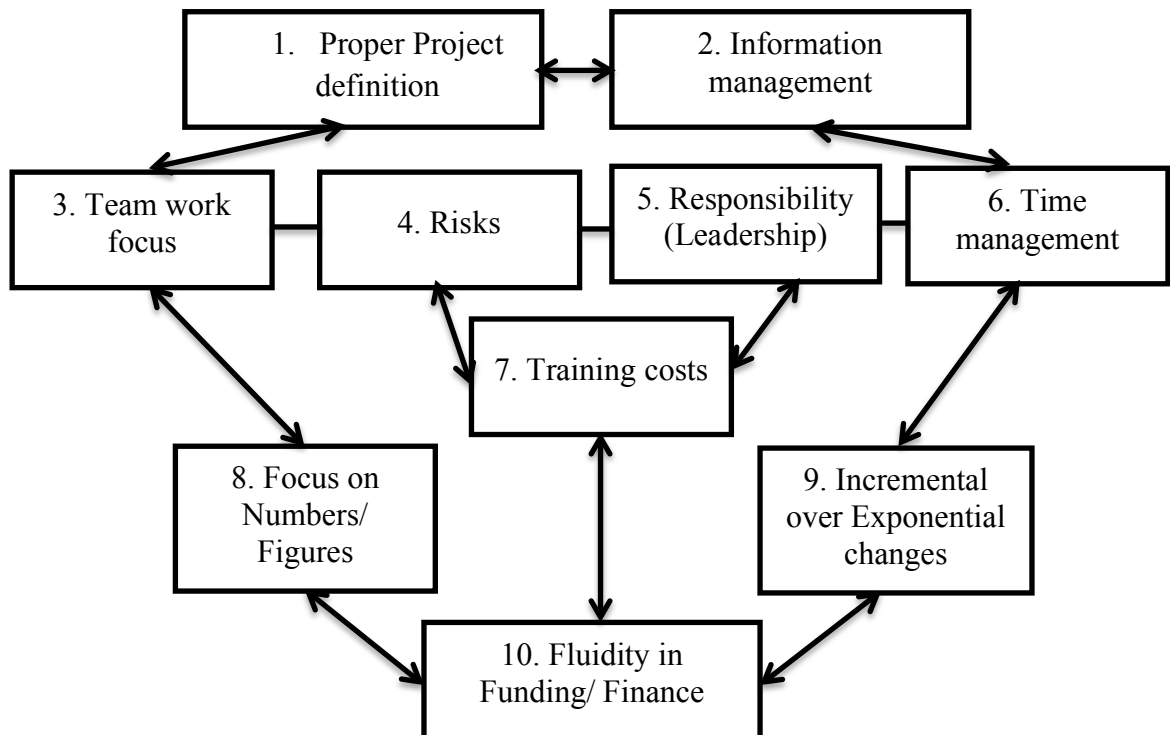


Figure 1: Barriers to the Implenementation of Quality Management

The interrelationship between the barriers to quality management implementation are highlighted in figure 1. A brief description of these barriers is offered to enhance clarity when considering construction projects.

1. Proper Project definition: There has to be a clear and succinct explanation of project aim and objectives as well as project success criteria. Conflicting ideologies of the construction project between stakeholders (client, contractor, supplier, customer, etc.) have to be addressed and understood by all parties involved. This would ensure clarity of goal and focus on quality outcomes (Hoonakker et al, 2010).
2. Information Management: Communication and coordination must exist between project participants or stakeholders. A mix of formal, informal, verbal or written communication has to be employed to accommodate all cadres of the stakeholders (Turner and Muller 2004). Poor management of information leads to conflict between stakeholders and its effects are high in the planning and design phrases of construction projects.
3. Team work focus: A goal oriented project approach needs to be engaged through the use of project teams. Experts or specialists should head teams to enhance collaboration as this would encourage downward knowledge transfer in and between teams to achieve project success (Busseri and Palmer 2000).
4. Risk management: Absence of a thorough risk assessment, identifying possible occurrences and appropriate solutions to reduce or eliminate such risks. Socio- political uncertainties such as change in power, bureaucracy in obtaining funding, and project creep greatly influence the quality of the finished construction project (Olalusi and Otunola, 2012)

5. Responsibility: The absence of responsible leadership in the various cadres of stakeholders is seen as a barrier to quality management implementation in Nigerian construction projects. If leadership is not enforced at various cadres, stakeholders will not be able to make prompt decisions when due and their accountability may not be guaranteed. However, adequate information management would ensure knowledge of construction and quality activities and spread the responsibility for quality between all project participants (Leung et al, 2008; Oluwakiyesi, 2011).
6. Time management: Effective use of labour and manpower through detailed planning to avoid time lag due to man hour losses. Improper management of time results in the compromise of quality and its management (Hoonakker et al, 2010).
7. High Training costs: Training on the use of quality tools is very essential. However, the high costs associated with the training of personnel, especially as projects are temporary operations, aids the avoidance of training. Organisations avoid spending on training thus leaving personnel unprepared to do excellent jobs especially regarding the management of quality (Olalusi and Otunola 2012).
8. Focus on Numbers/ Figures: Wrong evaluation of project delivery success based on number of projects completed, against projects constructed fit for purpose. Emphasis has to be placed on the nature of the finished project and the fulfilment of design requirements, rather than its completion (Hoonakker et al, 2010).
9. Incremental over exponential changes: Absence of knowledge management philosophy, making incremental changes by learning from past experiences. Every project is treated as an entirely new construction from planning to handover. Continuity of learning has to exist between successive projects, despite the change in stakeholders (Anumba et al., 2008).
10. Fluidity in Funding/ Finance: There has to be a feasible funding and financial plan for the project. The nature of project funding, its added bureaucracy as well as delayed payments which are typical to Nigerian construction projects greatly hinders quality management implementation and affects final project quality (Olalusi and Otunola 2012).

Conclusion

This article has highlighted the role stakeholders have to play in enhancing the implementation of quality management in Nigerian construction projects. The 25 quality attributes outlined represent diverse aspects of the construction process where improvements on the final project can be obtained through quality management. Major barriers also exist that hinder the effective implementation of quality management and in turn affect stakeholder satisfaction. Efforts should be made by the project team to raise awareness on the barriers to quality management implementation, and develop strategic plans to overcome these barriers. Since projects are temporary endeavours, it is usually assumed that training of appropriate stakeholders may be ineffective for a particular project. However, the possession of recent training certification by employees or specialists may be included as a stakeholder selection criterion. In addition, the impact of these barriers on the achievement of quality in Nigerian construction projects presents itself as a viable gap to be researched. Such a research will contribute to increasing the levels of

quality management and stakeholder satisfaction in the Nigerian construction setting.

Recommendations

It is however recommended that for future research, a study be carried out on construction projects in Nigeria to determine the existence and level of stakeholder involvement in quality management and shortcomings therein. Additionally, efforts to enhance satisfaction from construction projects in Nigeria should be researched and incorporated into the project success criteria and these can be obtained through post project evaluations. Although the generic principles of quality management and stakeholder satisfaction are known, their dynamics in the Nigerian context is subject to research to decipher the critical enablers and barriers and how these can be contextualised to the Nigerian setting.

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Prerequisites of the process-value management in consumer cooperation

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Abstract

Running business activity, many consumer cooperation organisations of Russian Federation are unable to generate enough equity funds to realise their social mission. The author outlines the characteristic of the consumer societies and the consumer societies unions. According to the author this characteristic helps to reveal the prerequisites of the process-value management (PVM) implementation to the consumer cooperation organisations.

Keywords

Business-process, consumer cooperation, process-value management, system analysis

Introduction

The mission of consumer cooperation, organisational structure of system and feature of the relations of property allow us to consider the activity of consumer societies and their unions as special object of management in the conditions of modern national economy. On the one hand, it is the coordinated system of the trade, industrial, transport, agricultural and other organisations, which facilitates competition with the large network companies. On the other hand, the organisations of consumer cooperation implement social mission providing considerable part of the inhabitants of the village with workplaces, bearing social responsibility, promoting development of rural areas, creating conditions for infrastructure improvement and taking part in implementation of national priority projects.

At the same time, many cooperative organisations running business activity aren't able to generate enough equity funds to realise the social mission. Solving the problem concerns the revision of traditionally established practices and methods of control over the business processes forming activity of the cooperative organisations.

The circumstances mentioned above allowed the author to introduce the PVM as the priority guidelines of the administrative theory and practice of consumer cooperatives development.

Characteristic of legal entities associations in the field of entrepreneurship

Characterising the conditions inducing the development of PVM introduction problems, it should be mentioned that the tendency of creating integrated companies, groups of companies is getting more distinct in Russia. Results of researches of domestic economy institutional problems, conducted by the Higher

school of economy of the Russian Federation, testify that nowadays an economic unit is not a separate "firm" but "business", i.e. a set of several firms united by one owner or a group of owners. There are various names for such associations: an integrated corporate structure, a united-diversified system, an integrated business group, a financial industrial group, or a holding.

"Association" is a special concept used for denoting various forms of integration, cooperation, economic interrelation and interdependence of businessmen in legal literature. For differentiating these forms of associations from other collectives they are called entrepreneur associations as the purpose of their creation is to implement the coordinated activity directed on systematic profit gaining.

According to the Russian legislation enterprise associations are created in the form of holdings, financial and industrial groups, simple association, associations, the unions and non-profit partnerships.

Widespread forms of enterprise associations are holdings. Forming holdings from state participation companies is regarded by many analysts as a way of increasing the management effectiveness with the help of centralisation of the investment resources and the coordination of production programmes. As the main prerequisite of small and medium enterprises groups' emergence, the experts call taxation optimisation by means of application of transfer pricing.

Non-profit partnership is the non-profit membership-founded organisation. It can be founded by citizens and (or) legal entities for its member assistance in implementation of activity, directed to the achieving of the social, charitable, cultural, educational, scientific and administrative purposes, and other purposes directed to the achievement of public goods.

Thus, the institutional environment of national economy has a great impact on formation of the theoretical bases of PVM.

Process-value management in consumer cooperation: possibilities and restrictions

The basis of the process-value management in consumer cooperation

According to the author, the core of the PVM in consumer cooperation is the application of system and process approaches. The arguments in favour of this statement are:

- consumer cooperation inherits not only the properties of the systems in general, but the properties of social and economic systems in particular;
- activity of the organisations of consumer cooperation is presented by various branches, which differ in specifics of development, organisational and economic characteristics, a financial condition;
- the system of consumer cooperation can change parameter characteristics of activity, structure of the functional relations, organisational structure according to the external conditions.

At the same time, scientists note drawbacks of modern management of the consumer cooperation. Their influence can be reduced by introducing the PVM. For example, M. V. Hayrullina (2006) considers that the top-level management lacks the methodology of social, economic, historical, political processes research. The analysis of special literature stated the absence of the integrated approach in the

research of the cooperative organisation management process. The cooperative organisation is viewed as the system functioning on the basis of the set of resources, processes and results. Thus there is a possibility of adaptation of modern control methods to the activities of the cooperative organisations.

Organising and functioning principles of the vertically integrated structures and their application to the cooperative organisations activities

The regional consumer union represents entrepreneur association, though it does not possess the status, but it has the coordinated economic policy and it acts in the market. To investigate the possibility of management methods adaptation of the integrated companies to the activity of the cooperative organisations we will consider the basic principles of the organisation and functions of vertically integrated structures:

1. Integrity principle.
2. Centralism principle.
3. Equality and independence principle of holding participants.

The content of the integrity principle of holding is shown in the following statements.

1. Investment of the holding participants with necessary means.
2. Appointment of the heads of holding participants responsible for the overall performance.
3. Oneness of the activity conditions for all economic societies entering the holding.

For the consumer cooperation organisations the principle of integrity is not applicable. According to the legal and economic nature of creating and functioning of consumer societies and unions, there is no mechanism to appoint the heads of cooperative organisations and to endue them with the material and monetary resources.

The centralism principle fixes the hierarchical structure of holding and defines subordination between its participants:

1. Division of strategic and operational planning.
2. The conditions observance control.
3. Managing director or head society allocations.
4. Non-interference to operational management.
5. Openness of accountable societies to checks from operating society.
6. One-man management observance in the management of the dependent society. The personnel of the dependent society is responsible only to the management of the economic society.
7. The reporting, planning, terms violation.

The principle of centralism is not applicable to the organisations of consumer cooperation as the hierarchical structure of holding doesn't correspond to organisational structure of the system of consumer cooperation. Thus the majority of statements of this principle contradicts the standards of the Civil code and the Law "About Consumer Cooperation (Consumer Societies, Their Unions) in Russian Federation".

The equality principle of economic societies-participants of holding is shown in the

following statements:

1. Mutually beneficial cooperation.
2. Keeping the interests of the economic society of a holding.
3. Partners freedom of choice.

The principle of equality of holding participants is fully applicable to the activity of the cooperative organisations.

In the result of the analysis of the functioning principles of holding structures it is revealed that the consumer societies unions can't be considered as a peculiar holding as the basic principles of the organisation and functioning of vertically integrated structures don't answer the nature of emergence and functioning of consumer societies and their unions.

Taking into consideration the complexity of organisational structure and the specific nature of such an economic "formation" as the unions of consumer societies, there was applied the technique of setting the goals on the basis of the existing problems. It also helped to justify the necessity of introduction of PVM elements into the organisations of consumer cooperation. V. V. Repin, V. G. Eliferov's (2006) works describe how to set a goal for the definite project analysing the existing problems.

It is necessary to adapt the methodology of goal setting to the consumer cooperation organisation activities. According to the author introduction of PVM allows the cooperative organisations:

- to optimise a control system, to make it transparent for the management of the enterprises, consumer societies, the unions and the shareholders, and to make it flexible to react to changes;
- to create and maintain the system of indicators and criteria of assessment of management efficiency at each level and activity stage;
- to provide confidence of shareholders that the existing control system is aimed at continuous increase of activity efficiency and shareholders, the population and public authorities;
- to assume the existence of an adequate information system, permitting the formation of objective and structured information on the results of activity of the cooperative organisations.

Peculiarities of the cooperative organisations activities that determine the realisation of the process-value management potential

According to the author it is necessary to apply some analytical procedures of the qualitative and quantitative content to confirm the need of introduction of PVM. It also helps to receive the general idea of the specifics, scales and an orientation of the union of consumer societies activity. The sources of information for the situation analysis of the system of consumer cooperation were the data provided by Novosibirsk union of consumer societies and by CCCD of RF 2015 (2008). The enactments and standard regulations defining the activity of the organisations of consumer cooperation were analysed, and the monographic analysis of theoretical and applied researches of problems of system has been carried out. Problems and features which define the mechanism of introduction of PVM to the activity of the organisations of consumer cooperation are outlined in Table 1.

Table 1: Characteristics of consumer societies and union activity defining the implementation of the PVM potential

Peculiarities of activity	Influential basis for implementing the PVM method
Multiindustry activity	Implementation within one legal entity of trade, production, procuring and other activity defines the specific approach to the allocation of processes, subprocesses and operations
Organisations, forming district or regional unions are separated territorially	Need of formation of a logistic chain taking into account belonging to the union of consumer societies and a geographical arrangement
Organisations are united by economic interests and control relations	Formation and use of system of indicators and criteria of efficiency for planning, managements, the account, control and the analysis of processes and activity
System of consumer cooperation and organisations, forming it, are socially significant.	The need to single out the key processes and system of the indicators characterising social activity of the organisations of consumer cooperation Establishing the interrelation between the results of business and social activity of consumer societies and their unions
Difficulties of the current control from the union heading and shareholders (are strategic or have retrospective character)	Formation of the documents describing and regulating business processes and distribution of responsibility for results of activity of the organisations and definite processes
Reduction of taxis burden by implementing special tax regimes and activity distribution through legal entities	Need of allocation of the indicators characterising tax loading and defining expediency of application of special tax modes and "dividing" of activity

Thus, the organisations forming the system of consumer cooperation are characterised by regional dissociation, a vertical orientation of control, a various branch orientation of activity, an organisational and legal form, system of the taxation and other parameters defining the model of management.

The author singles out the processes that have essential impact on further development of all the system. First of all, this is the creation of economic societies in organisational and legal forms that were not typical to the system of consumer cooperation: closed joint stock companies, limited liability companies. Economic societies being the commercial organisations by law have some competitive advantages: decrease in expenses, use of modern technological decisions, methods of management and information technologies. The analysis of the cooperative organisations functioning showed that standard of the existing tax legislation does

not promote creation of the declared competitive advantages. This results from:

1. Range activity and other characteristics of the companies (implementation within one legal entity of wholesale and retail trade) predetermine the usage of a general regime of the taxation. Thus tax load of managing subjects, by experts calculations, is 10-12 times higher in comparison with special modes of the taxation: the simplified system of the taxation, uniform tax on imputed income for different activities;
2. Opacity of the of formation and property usage mechanism of the economic subjects called a federal or regional cooperative distribution network, doesn't allow to estimate the compliance of such a model to the declared purposes of preservation of the consumer cooperation property system.
3. Lack of clarity concerning the interaction mechanism between the consumer societies and the distribution networks doesn't allow us to formulate positive consequences of creation and functioning of distribution networks for the remote areas and settlements where trade is presented only by shops of consumer societies.

Participation of the consumer organisations in limited liability companies had the purpose to create special conditions for further applying special tax modes. Thus the modern legal system allocates the consumer society created in the form of consumer cooperative with the following competences: to be engaged in the activity directed at the satisfaction of needs of shareholders; to have the representations, branches of consumer society to create economic societies, and to carry out the rights according to the legislation of Russia; to participate in economic societies, cooperatives, and to be the investor in trust partnership. The owner of property of consumer society is the consumer society as the legal entity. Thus consumer society is liable for obligations with all its property. At the same time, the limited liability company can be founded by one or several persons. The authorised capital is divided into shares of the sizes determined by constituent documents.

Theoretical basis for allocating of the main business processes

The basic definitions of the main business processes and their distinctive features are given in Table 2. They are aimed to prove the theoretical approach.

Table 2: Theoretical basis for pointing the main business processes

Criteria for pointing the main business processes	Differential characteristic of the main business processes
Processes creating the product value added	They are reflecting the direction of the activities
Processes creating the product having value for the external client	They outline the business profile
Processes aimed at profit generating	They are the sources of profit generating

According to the author, the diverse activity of the consumer cooperation allows the successful application of the PVM methods. Thus activities of the cooperative organisations, are considered to be the main business processes.

The analysis of Russian Federation cooperative organisations activities

The analysis of statistical information on the activity of the cooperative organisations of Russia testifies that today the number of workers of consumer cooperation is about 250 000 people. The total volume of activity of the cooperative organisations in Russia for 2011 constituted 239,3 billion rubles that is 15,7 billion rubles more than in 2010. The main direction of their activity is retail trade (tab. 3).

Table 3: Structure of total activity of consumer unions for federal districts of Russian Federation, January-December 2011

Name of consumer unions	The shareholders number, thousand, 01.01.12.	Cumulative business volume, million rubles	% to the cumulative business volume					
			Sales, turnover	Foodservice industry, turnover	Wholesale turnover	Purchases of agricultural products and raw materials	Volume of production industry	Paid services for population
Central	480.0	44006	75.8	5.9	4.0	8.5	5.1	0.8
Norh-western	428.7	38621	72.9	5.2	7.3	5.7	7.8	1.0
South	169.7	11068	65.4	6.5	1.7	9.4	15.8	1.2
North Caucasian	1043.5	4930	55.4	4.3	8.2	18.8	6.9	6.4
Privolzhsky	986.2	84113	65.9	7.2	4.6	11.9	9.5	0.9
Urals	162.3	14273	74.1	5.7	5.4	7.4	6.7	0.7
Siberian	245.3	29921	74	5.3	2.3	8.9	7.9	1.6
Far Eastern	69.5	8232	68.2	4.6	4.8	5.6	14.8	2.1

According to the report "Results of the organisations of consumer cooperation in 2011" of Central Union of Consumer Societies of Russia (CUCS of Russia) (2011) the turnover of the retail trade in 2011 made 166,2 billion rubles, of which 70 percent (116,1 billion rubles) is the share of rural areas.

Purchase of agricultural products and raw materials is the second important activity of the cooperative organisations of Russia in 2011. Thus the share varies from 5,6% in the cooperative organisations of the Far East federal district to 18,8% in North Caucasus federal district (tab. 3).

More than 22 billion rubles was spent on purchasing agricultural production and raw materials in personal subsidiary farms of the population, country (farmer) farms and other small forms of managing in 2011. Cooperative enterprises released production on 20,5 billion rubles.

Activity of the consumer unions of Siberian federal district in 2011 is represented

by the retail and wholesale trade, public catering, purchases of agricultural production and raw materials, production of consumer goods and paid services. Thus retail trade and public catering, purchase of agricultural production and raw materials, production of consumer goods are significant kinds of activity. The wholesale trade income share and paid services do not exceed 3% (tab. 4).

Table 4: Structure of the cumulative business volume of consumer unions of Siberian Federal District, 2011

Name of consumer unions	The shareholders number, thousand 01.01.12.	Cumulative business volume, million rubles	% to the cumulative business volume					
			Sales turnover	Foodservice industry, turnover	Wholesale, turnover	Purchases of agricultural products and raw materials	Volume of production industry	Paid services for population
Siberian	245.3	29921	74	5.3	2.3	8.9	7.9	1.6
Respublic of Altai	4.9	331	70.1	6.1	0.7	2.7	13.3	7.0
Buryat	13.2	2449	71.6	3.4	3.8	12.2	5.1	4.0
Tuva	4.6	612	57.9	7.0	6.4	4.6	13.6	10.5
Khakassia	8.9	490	67.3	11.0	5.4	8.8	5.3	2.2
Altai	22.6	7118	77.0	4.1	1.7	9.1	7.4	0.7
«The North Community»	0.02	184	72.0	2.3	6.5	13.5	4.4	1.3
Irkutsk	42.2	2577	72.4	7.8	2.4	6.5	9.0	1.8
Kemerovo	30.2	3598	74.8	4.2	0.6	11.5	7.6	1.4
Novosibirsk	67.4	7895	80.6	4.1	2.2	6.3	5.5	1.3
Omsk	37.3	1689	61.1	6.2	6.8	10.7	14.4	0.7
Tomsk	11.1	1815	54.7	14.1	0.1	16.7	13.9	0.5
Transbaikal	2.6	1163	79.5	3.6	0.7	5.1	10.6	0.5

The structure of total volume of activity as a whole across Siberian federal district is typical for all regional consumer unions. The conclusions of the analysis of the consumer unions activity in Siberian federal district coincides with the problems designated in the CCCD of RF 2015 (2008). Trade is one of the main and traditional activities of the consumer cooperation. At the same time, there are essential features that have to be considered while defining the key directions of trade in consumer cooperation development. The advantages distinguishing trade enterprises of consumer cooperation according to the CCCD of RF 2015 (2008) are as follows:

1. The system has more than 47 thousand operating shops with a cumulative area of 3,2 mln. sq.m.
2. Trade serves 60% of country people.
3. Shops of consumer cooperation in rural areas are the centres of public life for many settlements.

Procurement made by personal subsidiary farms, farms and the organisations of small forms, collecting wild-growing plants, secondary, fur and raw materials, products of national crafts are key activities of the organisations of consumer cooperation. This branch plays an important role in the revival of the village and the development of rural infrastructure and creation of workplaces in rural areas. Accumulation of procuring activity volumes is of great importance for realisation of the State program of agriculture development for 2013-2020 and protection of safety interests of Russia in the sphere of food supply (RFGP July 14, 2012 № 717.).

The production sphere of consumer cooperation is characterised by the following problems (CCCD of RF 2015, 2008):

1. Small and medium enterprises aren't connected by the complex strategy of development.
2. Decisions on creation, profile definition, reshaping and liquidation of the enterprises, are accepted on an uncoordinated basis at the level of consumer societies, sometimes at the level of consumer societies unions without considering the general development of cooperative production system and the position on the local and regional markets.
3. Small enterprises are often economically inefficient as they duplicate each other in markets, create the internal competition to other organisations of consumer cooperation, or they are unprofitable owing to other objective economic factors.

For solving the problems listed above it is advisable to use the experience of the regional consumer unions which activity testifies to management efficiency on the one hand and, shows the high potential of the cooperative organisations on the another hand.

For example, results of activity of the cooperative organisations of the Krasnoyarsk regional union for 2011 differ from the general situation in Russia, and Siberian federal district in particular. Structure of the activity of the Krasnoyarsk regional union of consumer societies for 2011 is as follows (specific weight): retail commodity turnover – 41%, rendering paid services – 4%, production of agricultural products – 1%, a procuring turn – 8%, a turn of public catering – 4%, a wholesale turn – 16%, production of an industrial output – 20%, other types – 7%.

The total volume of economic activity of 67 organisations entering the regional union of consumer societies made more than 3 million rubles with growth rate to level of last year of 110,7%, including on retail trade – 105,3%, to public catering – 107, 1%, wholesale trade – 120,4%, a production activity – 106%, procuring – 106,7%, to rendering paid and household services to the population – 102,9% for 2011.

1. The turn of trade enterprises of Krasnoyarsk regional union of consumer societies and public catering made more than 1,8 million rubles with growth of 108,9%. Release of own production increased on 8,7 million rubles and

made 83 million rubles. The share of own production in a turn of public catering makes 80%.

2. Commodity turnover of wholesale trade grew and made 470 million rubles in 2011.
3. There was procured and bought different agricultural products and raw materials for 232 million rubles, with growth rate to level of last year of 106,7%.

The priority directions of the consumer cooperation system development of Krasnoyarsk Krai are the procuring production activity with the maximum use of local resources and a services sector.

The branch of rendering paid services to the population develops dynamically. The volume of paid services for 2011 made 120 million rubles with the growth rate to the level of last year of 103%, including the volume of household services of 30 million rubles, with the increase by 2010 for 9,75%. All fields of activity are profitable (KUCS 2011).

Based on the results of the analysis of Krasnoyarsk regional union of consumer societies, it is possible to state: the methods of management applied to the cooperative organisations increase productivity of the organisation as a whole and separate fields of activity in particular.

Conclusion

The main prerequisites to the development of the system of consumer cooperation in a modern situation consist of the following: there are prospects in each kind of activity. The development of the traditional and new kinds of activity requires the mechanism of management based on modern achievements of management and focused on dual nature of activity of the organisations of consumer cooperation.

Considering of problems of consumer cooperation management from the positions of systemacity reveals important communications, complementarity between the enterprises, development of technologies and the information streams forming real knowledge of the situation in system, separate consumer societies and their unions. But it should be noted that existing approaches of PVM aren't adapted for the features of the cooperative organisations. Any of the approaches known nowadays have no sequence of administrative action performance, the list of necessary and reliable information sources, reasonable system of the key interconnected indicators which can give a complex assessment of the activity of the organisation from the position of property preservation and an increase in value of consumer cooperation business.

The general characteristic of consumer cooperation organisations activity helped to allocate problems and peculiarities that define prerequisites of PVM introduction (see tab.1).

To get the idea of financial and economic activity of the cooperative organisations system, it is necessary to apply methods of the economic analysis, results of the analysis of the enactments and standard regulations. So, for the consumer societies belonging to the system of the regional consumer union, it is typical to apply various modes of the taxation. This defines basic distinctions in definition of financial results, the income and expenses. So, starting opportunities of the enterprises should be considered. Therefore it is necessary to describe the actions

that provide the introduction of the PVM into the consumer cooperation. Firstly, it is necessary to reveal the key processes of information that influence the formation of the system of business processes. Secondly, it is important to define the sequence of these processes and their interrelation. Further, it is necessary to establish criteria and the methods necessary for an assessment of productivity of these processes and their management.

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A Scale of Measures for Evaluating Effectiveness of Facilities Management Service in Office Buildings in Lagos-Nigeria

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Abstract

Facilities management (FM) application in Nigeria is constrained by particular socio-economic conditions which make it prone to crises situations. This research identifies appropriate parameters for evaluating the level of effectiveness of FM service, reflecting the country's peculiarities. The research adopts cross sectional survey design. The data were obtained using self-administered questionnaires and were analysed using statistical tools such as means, standard deviation and chi-square. The research developed a multi-item scale of 41 measures in three categories i.e. "financial", "quality of service" and "crises response and management". This third category is a new dimension that was uncovered by this study for the Nigerian context and by extension to the context of the developing world. The research found that "prevention of fire, accidents, health and other emergencies" and "response plan to these situations" are the two most important measures of FM effectiveness, while measures of professionalism of FM staff are perceived to be relatively less important.

Keywords

Effectiveness of facilities management service, Lagos-Nigeria, Office buildings, Scale of measures

Introduction

Globally, a wide gap persists between the expectations of building users and the quality of services provided by practitioners towards the fulfillment of these expectations. The lack of objective quantification of user requirements and expectations has been identified as one important reason for this gap (Augenbroe and Park, 2005). The availability of appropriate measures for evaluating the effectiveness of (FM) services is therefore important in bridging this gap and invariably in the successful delivery of buildings.

Effectiveness of FM services could be viewed as the extent to which the service provider is able to make facilities support the aim and strategic objectives of an organization. It is also a measure of how adequate FM is at identifying the needs of the users and its ability to put in place proper provisions to satisfy such needs and hence enhance their productivity. Effective FM provides a safe, comfortable and productive working environment.

Facilities management application in Nigeria is constrained by peculiar socio-economic and cultural conditions, which creates a greater need to develop a contextual

scale of measures for evaluating its effectiveness. These conditions include: low ICT (Information and computer technology) integration, poor information disclosures, particularly financial information (Umoren, 2009; Games, 2011) and inadequate infrastructural development. Some other constraints are recurrent building and public service emergencies, bad economic condition and imminent high poverty levels, poor health and safety regulation and poor standards enforcement. These constraints makes FM application in Nigeria prone to crises such as incessant breakdown of machinery and equipment, disruptions in supply of utilities, frequent building collapse, fire incidents and more recently, issues of kidnapping for ransom and suicide bomb attacks.

In FM, measurement of effectiveness cannot be informative and could actually be misleading where inappropriate measures have been used. In recognition of this, many studies have attempted to identify important measures of the effectiveness of FM in different countries (Barret, 1995; Hinks and McNay, 1999; Amaratunga *et al*, 2000; Shohet, 2006; Moss *et al*, 2007; Lam *et al*, 2010). Contrarily, limited research has been done in this area in the Nigerian context. Where the effectiveness of FM services continues to be evaluated using measures that are mismatched with the context of the environment not only would the gap between users' needs and expectations persist but the successful delivery of building support services would also be hindered.

In view of the foregoing the aim of this study is to develop a scale of objective, contextual and user focused measures for evaluating the effectiveness of FM services in office buildings, in Lagos, Nigeria, with a view to identifying those important requirements in the successful delivery of building and its support services. This aim was achieved through the following specific objectives

- Identifying measures of FM effectiveness, using past literature and discussions
- Determining the level of importance of these measures from the perspective of office building users and facilities managers, in Lagos, Nigeria.
- Determining the more important and less important measures and category of measures.

Literature Review

Assessment of Effectiveness of FM Service

The added value of FM to organization comprises both the tangible and the intangibles (Nelson 2006). The intangible aspect cannot be visualized, inventoried, counted or tested and it is heterogeneous (Clark *et al.*, 2003). Therefore it has to be viewed as overall attitude held by customers towards the service. Financial (tangible) performance measures, concentrate on the contribution of FM from the angle of operational efficiency and cost. It perceives property as a cost that needs to be controlled, instead of an asset that creates added value to the business. Varcoe (1996) discourages use of financial measures, which according to him originated from the need to satisfy external financial accounting, such as audit and tax. Another important characteristic of traditional financial measurement system is that it failed to provide managers with the information that they needed to measure and manage the all-important FM competencies that drive competitive advantage (Amaratunga *et al*, 2000). Measures incorporating non-financial measures have been found to be capable of overcoming these limitations of the financial measures. Therefore, an appropriate measure for effectiveness in FM must measure from the financial, building condition, service and customer perspectives.

Measures of Effectiveness of FM Services

Newing (1995) noted that effective facilities management must pay attention to issues of employee commitment, customer satisfaction, risk process and organizational control. Other dimensions of effectiveness according to Barret (1995) and Amaratunga et al. (2000) are process performance, managerial behaviour and product or service innovation. Hinks and McNay (1999) featured important measurement dimensions such as client satisfaction, responsiveness, service reliability, safety, staff performance and cost effectiveness and comprises important individual factors that are measurable.

Table 1: Key performance measures for FM providers

- | |
|---|
| <ul style="list-style-type: none">-No loss of business due to failure in premises services-Customer satisfaction-Completion of project to customer satisfaction-Provision of safe environment-Effective utilisation of space-Effectiveness of communication-Reliability-Professional approach of the premises staff-Competence of staff-Management of maintenance-Responsiveness of FM department-Changes and requirements-Value of money-Satisfactory physical working condition- Relevance of equipment provided-Suitability of premises and work environment.-Quality of end product-Effectiveness of FM helpdesk service-achievement of completion deadlines-Correction of faults-Standard of cleaning-Management Information-Energy performance. |
|---|

Source: Hinks and McNay (1999)

Table 1 displays some of the more important measures that were featured in the model some of which were adapted and used in this current study. Some of the important measures of FM service that were indicated in the works of Leaman and Bordass (2001) and Pickard (2006) includes, quality of complaint desk or feedback procedure, nature of problem reporting procedures, quickness of response, how integrated are the problem rectifying attempts, how efficient are the response to computer crashes, the amount of downtime, availability of productivity enhancing intervention, effectiveness of maintenance regime and reliability of services. Others are sensitivity of the FM staff, efficiency of security system, and level of absenteeism of FM staff.

Some of the financial measures indicated by Lindholm and Nenonen (2006), Lindholm and Leväinen (2006) and Amaratunga et., al (2000) include occupancy cost per head,

vacancy rate, occupancy cost per, square foot/metre, total operating cost per annum, maintenance cost per square meter, maintenance cost per annum for major item, etc.

Method of Research

This study is limited to Lagos metropolis, Nigeria's financial, commercial and industrial nerve centre. The city attracts 65% of Nigeria's commercial activities and accounts for about 40% of the labour emoluments paid in the country (Lagos State Government 2011). In view of its commercial nature and the predominance of offices buildings it is presumed that findings from this study area can provide a veritable guide for other parts of the country.

The research adopts a cross sectional survey design. This has been used in similar researches such as Apgar (1995), Atkin and Brooks (2000), Ho *et al.* (2000), Clark *et al.* (2003), Lindholm and Levainen (2006), VanMossel (2008), Lavy *et al.* (2010) and Bryne (2011).

The study population comprises all users (occupiers) and facilities managers of purpose-built office buildings in Lagos metropolis which possesses certain characteristics which include;

- 1) The existence of a well-established building support service and
- 2) Absence of major building renovations that could disrupt services to users at the time of this study.
- 3) Absence of change in service providers in the last one year or ongoing change

Defining the population from this group of buildings is in an attempt to generate the sample from a homogeneous population with little variability (McQueen and Knusson, 1999, cited in Adenuga 2008) and to make effective FM process easily discernible. Sampling for the two groups of respondents was done using multi-staged sampling with a combination of stratified and random sampling methods at the first and second stages respectively. The size of the sample used in the study was 492 made up of 369 and 123 building users' and service providers respectively. 254 responses, representing 51.6% were obtained.

Data were collected from primary sources using self-administered survey questionnaires. Consumer perspective is influenced by core side strategic performance requirements, it is therefore crucial to this study. User based survey has been used in FM performance studies such as, Leifer (1998), Rogers (2003), Pickard (2006) and Tucker and Pitt (2008). Sarshar and Pitt (2009) explained that for those aspects of performance that may not be visible to building users the researcher may have to contend with the views of the FM staff. Hence, this study used the building occupants' perspectives for the non-financial soft measures and FM service provider's perspectives in the case of the financial measures, which were presumed to be less visible to the users.

The research featured 42 measures in three (3) categories. Hence eight (8) are in the financial category, 22 in the quality of service category and 12 are in the crises response and management category. These measures were obtained both from literature and from an interview with a focus group of Ph.D. candidates in the construction industry. The "response to crises category of variables is an innovation of this research introduced to provide for the crises prone context of the Nigerian FM practice as discussed earlier. Hence, variables in this category were obtained mostly from the researcher's line of thought, interviews with experts both in practice and

academia, the researcher's supervisors and the focus group mentioned above. A few of the variables were indicated under risk factors by previous authors. The respondents were required to rate the measures on a likert scale of 1-5 based on their perceived importance as measures of FM effectiveness. The interpretation of the rating is as follows: not important (1), hardly important (2), somewhat important (3), important (4) and very important (5).

The data in this study were analysed using parametric statistics such as mean, standard deviation, chi-square and ranking. Likert scale has been analysed by many researchers in the FM subject area with different combinations of parametric analysis. Examples of such studies are Bottom (1998), Lavy *et al.* (2010) and Bryne (2011). The criterion that was used for the inclusion a variable in the developed scale of measures was a mean importance rating of 3.5, which is midway between "somewhat important" (a score of 3) and "important" (a score of 4). Hence variables having mean value lower than this criterion if any were dropped out of the scale. The mean values were also used to rank the variables in a descending order thereby making the relatively more important variables and the less important ones readily discernible. The standard deviation indicated the level of agreement for the rating of each variable by the respondents.

The content validity of the research instrument was done by eight (8) experts (Four in the academia and the other four in FM practice). The pilot study provided further validation. Reliability test for this study was done using coefficient alpha which is said to be preferable for summated rating scales (Asika, 2004). This was found to be 0.918. This figure is significantly more than the satisfactory 0.7 and 0.6 values recommended in Robson (2002) and Asika (2004) respectively, implying that the data used in this study are adequately reliable.

Result Presentation and Discussion of Findings

Table 2 to 4 presents the mean ratings for the 42 measures of effectiveness of FM service that were featured in this study, under the three different categories. The table also presents their ranking overall and within each group. The mean values were individually subjected to chi square test for significance at 99% and at the degree of freedom indicated for each of them. The results as shown in the tables indicate that the chi-square value for each variable is significant at 99%, thus establishing that the variations in their mean values are real. This implies that the variations in the rank of their importance is also real and not just a result of random variation.

Users rated 39 out of the 42 measures as important and above (mean ratings > 4). This indicates that users considered these 39 measures as quite important measures of FM effectiveness. The three measures that were rated lower than 4 are; "Average annual percentage of vacancy in property" (3.84), "Level of absenteeism of FM/premises staff" (3.82) and "Number of prospective tenants who show interests in renting space per month" (1.27 - not important). This implies that although the first two of these last three variables are rated in the "somewhat important" scale (3 - 4) they still qualify to be included in the scale of measures as both scores are greater than the 3.5 cut off criterion.

It was also found that 40 of the 42 variables have standard deviation values that are less than a unit value of 1 (0.583 - 0.999), while the 41st has standard deviation value slightly higher than 1 (1.192). For a scale with a possible maximum score of 5, standard deviation values that are less than 1 unit is a good indication as it

indicates that there is a high consensus in the rating of the importance of these variables among the respondents.

Table 2: Mean and Standard Deviations of the Importance Rating of Measures in the Response to crises category

Measures	Df	Std. Devt	Mean	Over-all Rank	Rank in Group	Chi-square	Sign level
Prevention of fire, accidents and health emergencies	180	0.637	4.69	1	1	370.6	0.01
Plan of action in case there is fire accidents or other health emergencies within the building	177	0.659	4.60	2	2	201.4	0.01
Response plan to main electric power outage and other sources of power	182	0.785	4.49	5	3	168.6	0.01
Response plan to failure in public mains water and other water supply sources	178	0.856	4.43	10	4	220.6	0.01
Provision for response to leakages	181	0.797	4.34	17	5	189.4	0.01
Managing unexpected breakdown of fixtures and fittings	180	0.759	4.27	23	6	208.6	0.01
Provision to ensure that only qualified and efficient artisans are engaged	180	0.779	4.26	25	7	172.9	0.01
Response to plan to breakdown of equipment from power surges etc.	182	0.891	4.19	33	8	141.7	0.01
Response plan to scarcity of required materials	182	0.972	4.18	34	9	155.7	0.01
Managing effect of corruption and lack of transparency of service officials and artisans	181	0.934	4.08	36	10	109.5	0.01
Managing instances of adulteration and fake equipment and spare parts	176	0.985	4.05	36	11	111.2	0.01
Managing effect of hectic and unpredictable traffic situation on quality of service	179	0.918	4.00	39	12	123.4	0.01

Table 3: Mean and Standard Deviations of the Importance Rating of Measures in the Financial category

Measures	Df	Std. Deviatn	Mean	Over-all Rank	Rank in Group	Chi-square	Sign level
Occupancy cost per annum per square metre/foot	48	0.771	4.54	3	1	48.8	0.01
Total operating cost per annum per square metre	46	0.750	4.44	8	2	33.8	0.01
Rent earned by building per square metre	48	0.765	4.40	11	3	31.8	0.01
Maintenance cost per square metre or foot	48	0.644	4.40	11	4	31.8	0.01
Total operating cost per square metre for individual major item of overhead	49	0.755	4.37	15	5	10.1	0.01
Total asset value	47	0.942	4.36	16	6	53.3	0.01

Average annual percentage of vacancy in property	46	1.192	3.85	40	7	22.5	0.01
Number of prospective tenants who show interests in renting space per month	46	3.652	1.27	42	8	10.7	0.01

Table 4: Mean and Standard Deviations of the Importance Rating of Measures in the Quality of service Category

Measures	Df	Std. Deviatn	Mean	Over-all Rank	Rank in Group	Chi-square	Sign level
Use of quality materials in providing service	178	0.622	4.52	4	1	162.2	0.01
Provision of safe environment	175	0.685	4.47	6	2	140.6	0.01
Effective and timely correction of faults	175	0.667	4.46	7	3	139.8	0.01
Customer satisfaction with facilities	178	0.638	4.44	8	4	138.0	0.01
Completion of works to customer requirement and time deadline	180	0.655	4.39	13	5	136.3	0.01
Satisfactory standard of cleaning	179	0.583	4.39	14	6	66.2	0.01
Effective management of maintenance functions	178	0.696	4.34	17	7	196.4	0.01
Suitability of building fittings and environment to work	177	0.675	4.32	19	8	112.8	0.01
Satisfaction with facilities and physical working condition	181	0.708	4.30	20	9	112.3	0.01
High level of energy performance	179	0.763	4.30	20	10	97.8	0.01
Effectiveness of communication provisions and management of information	180	0.687	4.28	22	11	32.7	0.01
Responsiveness of FM department	171	0.750	4.27	23	12	94.5	0.01
Avoidance of loss of business due to failure in premises services	176	0.881	4.26	25	13	152.1	0.01
Ability to meet legislative requirement in building	177	0.711	4.25	27	14	104.8	0.01
Reliability of building support service	178	0.756	4.25	28	15	97.9	0.01
Provision of serene and attractive environment	179	0.776	4.25	28	16	167.8	0.01
Provision of relevant and high quality equipment	180	0.763	4.23	30	17	100.0	0.01
Friendly and courteous premises staff	178	0.711	4.23	31	18	106.1	0.01
Good quality end product and ensuring value for work done by suppliers	178	0.778	4.22	32	19	97.7	0.01
High level competence and professional approach of premises staff	176	0.694	4.18	34	20	114.9	0.01
Effective and proactive complaint/help desk service	178	0.876	4.08	36	21	123.6	0.01
Level of absenteeism of FM/premises staff	177	0.999	3.82	41	22	98.7	0.01

In summary, only one (1) of the 42 variables that were featured in the study was considered clearly unimportant by the respondent i.e. “Number of prospective tenants who show interests in renting space per month” hence this was dropped out of the scale of measures, while the other 41 measures were retained. This indication is not totally unexpected. As some less important measures were identified and dropped out of the variables (57 in number) featured earlier, at the pilot study stage. The important measures with the exception of those in the crises response category (which is an innovation in this study) are consistent with those that have been indicated in previous studies such as Hinks & McNay (1999), Ho *et al.* (2000), Amaratunga *et al.* (2000), Leaman & Bordass (2001), Barret and Baldry (2003), Lindholm & Levainen (2006), Lindholm & Nenonen (2006) and Pickard (2006), Moss *et al.* (2007).

Variables in the crises response and management category such as “prevention of fire, accidents, health and other emergencies” and “response plan to these issues” were rated as the first two most important measures overall, with mean ratings of 4.69 and 4.60 (Table 2). This emphasizes the importance of the ability of the facilities manager to respond to accidents, fire and health emergencies. Issues of health and safety were similarly rated among the top ten important measures in past researches such as Hinks and McNay (1999) and Meng and Minogue (2011) but only as it relates to meeting legislative requirements on these issues and not response to the frequently recurring crises from them as in the Nigerian situation.

The ranking of occupancy cost as the 3rd overall most important measure of the effectiveness of FM by the respondents (mean value of 4.54) is an indication that a building’s running cost is as important to building operators as it is to the owners (Table 3). This was similar to the findings in Ho *et al.* (2000). Respondents acknowledged the negative impact of poor national standardisation policy on effectiveness of FM service by rating “Use of quality materials in providing service” as the 4th most important measure overall (Table 4). They also found measures relating to building and public service emergencies such as power failure and shortage of water supply as very important measures having mean ratings of 4.49 and 4.43 and ranking 5th and 10th overall respectively (Table 2). These factors unlike in previous researches where they may be important only as they relate to disaster recovery in the event of natural disasters are in Nigeria day to day aspects of operation of facilities. Issues of professionalism of FM staff were ranked lowly overall in terms of their relative importance. Hence measures such as “friendly and courteous premises staff”, “high level competence and professional approach of premises staff”, “Effective and proactive complaint/help desk service” and “Level of absenteeism of FM/premises staffs were rated 31st, 34th, 36th and 41st overall, respectively (Table 4). This is inconsistent with the findings in Hinks and McNay (1999) where they were perceived to be relatively more important.

As shown in Table 3, the three most highly rated financial variables i.e. “occupancy cost per annum per square metre” “total operating cost per annum per square metre” and “rent earned by building per square metre” appear to be relatively easier to calculate one lump sums that can be easily translated into a unit measurement of cost (Per square metre in each case). This suggests that Nigerians prefer the more straight forward and lump sum type of financial indicators, which require minimal knowledge of mathematics and computer analysis. It was also found that the investment quality related financial measures are less popular with the facilities

managers. For example, the two least ranked variables i.e. “number of prospective tenants who show interests in renting space per month” and “Average annual percentage of vacancy in property” are related to demand and invariably quality of property as an investment asset. This implies that respondents (FM operators) in this study put less emphasis on the performance of office buildings as investment. This is similar to the findings in Ho et al. (2000), where actual cost measures were more important than measures of effectiveness of these costs.

Measures that were rated most highly in the “quality of service” category (Table 4) were considered equally important, overall, with the top three measures; “use of quality materials in providing service” “provision of safe environment” and “effective and timely correction of faults” having mean values and overall rankings of 4.52 and 4th, 4.47 and 6th, and 4.46 and 7th respectively. Safety was equally rated highly in Myeda and Pitt (2011)

It is important to mention that the rating of the measures in this study indicates that users found measures in the “crises response and management” category (the new dimensions that was uncovered in this research) as quite important (Table 2). For example the two measures that were ranked as the top two are measures in this category, while four out of the first ten most important measures are also in this category. This justifies the inclusion of this category of measures as an innovation for the Nigerian context in this research.

Conclusion

The study developed an adaptable multi-item scale of measures which could be used in the assessment of the effectiveness of FM services on the one hand and in the creation of customer focused FM policy, for organizations and resource allocation on the other. The scale introduced a new measurement category i.e. “crises response and management” which makes the scale contextual to the Nigerian crises prone, socio-economic and cultural environment and by extension to the context of the developing world.

The study revealed that measures that are important to the Nigerian building users in the “financial” and “quality of service” categories are not too dissimilar to those in other nations according to literature. It also found that measures which quantify “prevention of accidents, fires, health and other emergencies” “the response to these situations” and “safety of the work environment” were perceived as very important soft measures of FM effectiveness. This is not surprising with the spate of health emergencies (people collapsing at work and dying at their desks), building collapse, incessant fire and other accidents. Others are the more recent suicide bombing incidents in Nigeria and the poor handling of these emergencies with the antecedent loss of live and resources.

Respondents rated highly, measures relating to prevention and response plans to building and public service emergencies, such as electric power outage and failure of public mains water supply. This supports the notion that a facility manager who wants to make a difference to the clients’ business in Nigeria must be up to task with these crises response and management aspects of his or her responsibilities.

This study reveals that financial measures of building performance as an investment property are less important to the Nigerian building operators while issues of running cost are quite important. It also indicated that measures of level of professionalism of

FM staff are relatively less important to the building users. This is probably a cultural influence, introduced by a general absence of service level expectations and monitoring, invariably resulting in the ethos of impunity and complacency, being enshrined in the Nigerian psyche.

This paper is an extraction from a broader ongoing research effort, in furtherance of which the researchers aspire to develop a veritable performance measurement tool for the measurement of performance of office buildings from demonstrable influence of the effectiveness of FM services in Nigeria. Therefore, there is scope for furthering the research by applying other statistical methods such as factor analyses to the data. This will indicate the important dimensions of the measures in the developed scale, while also validating them. Also, it is intended that in the near future, these measures will be tested empirically among applicable respondents in the study area for further validation.

Assumptions

The assumption that was made in this study is that every respondent in the building support service provider category is a facility manager of some sort. Also, that the building support service provided in each of the buildings in the survey is FM, even where his approach is not as proactive or strategic as is expected in FM. This is because the Nigerian FM practice is still in its infancy, hence most of the service providers operate at the level of the numerous traditional building support practices from which FM evolved, such as property management, corporate real estate management, maintenance management, asset management etc.

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Critical Success Factors for Stakeholder Management and Project Success in Construction Projects

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Abstract

Stakeholder management has been recognised as an important strategy for achieving success in construction projects. Previous research in construction stakeholder management identified critical success factors (CSFs) for stakeholder management in construction projects and grouped them under a number of categories such as precondition factors, information inputs, stakeholder estimation, decision making and sustainable support. Identification of these factors has led to development of frameworks for carrying out stakeholder management. However, previous efforts did not take into account important considerations such as selection of appropriate procurement route, adopting flexible project organisation, classifying the project stakeholders and how these groupings relate to project success. This paper provides a critical review of previous research efforts and the critical success factors for stakeholder management and justifies that there is still a need for an in-depth understanding of the relationships among the groups of critical success factors and how these factors facilitate project success through an effective stakeholder management. Relying on an extensive literature review on stakeholder management in construction projects; five theoretical constructs are proposed to model the relationships between groups of critical success factors for stakeholder management and project success: Sustainable top management support (STMS); Information input (II); Stakeholder estimation and analysis (SEA); Decision making and strategy formulation (DM); and Project objectives/success (PO). This model will contribute to knowledge and enable an effective stakeholder management process by showing the pattern and strength of relationships between the groups of critical success factors for stakeholder management and project success.

Keywords

Critical success factors, stakeholder management, project success, interrelationships, construction projects

Introduction

Despite continuous efforts aimed at improving project success in the construction industry it has seldom been a common ground for projects to be successfully delivered. Construction projects are generally unique in nature due to their processes and interaction with numerous parties within and around them. However, just like any other venture, they are constrained by time and resources (both human and material) which are needed for the projects to be delivered (Ibrahim and Nissen, 2003; Bourne, 2005). Construction projects are traditionally divided into series of

activities (operations) undertaken by different individuals or groups who may have different levels of interest and or involvement in the project (Egan, 1998). The lengthy process of design and execution of construction projects constitutes a complex system which involves collaboration and negotiations among many stakeholders which may include but not limited to the clients, designers, contractors, local authorities and the general project environment (Cheeks, 2003; Winch 2010). Some individuals or groups (such as labour union (employers' association), general public, the media, and institutional forces/nationalised industries (professional bodies) etc) may not be directly involved in the project but may have interest in and could be capable of influencing the project delivery process (Leung and Olomolaiye, 2010). In summary, parties involved directly or indirectly in the project are referred to as the project stakeholders whose management is vital to achieving project success.

Project failures have been attributed to either lack of or inadequacy of stakeholder management during the project (Black, 1995; Akintoye *et al.* 2003; Bourne, 2005; Olander and Landin, 2008). Stakeholder management on projects should be carried out in order to obtain the support and contributions of stakeholders as much as possible towards the project and achieve the best possible results (project success) (Olander and Landin, 2008; Jepsen and Eskerod, 2009). However, the perception of project success may not be as straight forward.

The word success can mean different things to different individuals and in different circumstances. Thus *“our views on project success have changed over the years from definitions that were limited to the implementation phase of the project life cycle to definitions that reflect an appreciation of success over the project and product life cycle”* (Jugdev and Muller, 2005). Similarly, project success has meant different things to different stakeholders involved in construction projects (Bryde and Brown 2005; Toor and Ogunlana 2008). For instance, while on the same project, contractors may focus more on minimising cost and duration of project; clients may focus more on satisfying the needs of other projects stakeholders (Bryde and Robinson, 2005). The traditional perception of project success being judged based on cost quality and time has changed over time to include; micro and macro viewpoints, stakeholder satisfaction, reduced conflicts and disputes and environmental friendliness (Lim and Mohamed, 1999; Cookie-Davies, 2002; Bryde and Brown 2005; Toor and Ogunlana 2010). Similarly, a construction project whose execution process and product are functional, profitable, devoid of claims and court proceedings and fit to purpose for users is considered a successful project (Takim and Akintoye, 2002). It now also requires that KPIs are set and achieved through the project in order for success to be attained (Chan and Chan 2004; Glenigan, 2011). Furthermore, project management success and project success have been confused one for the other or to mean the same thing. Project success depends heavily on project management success; however, it is possible for a project to fail in terms of project management and yet be able to satisfy the majority of the project stakeholders and this could also be the other way round (Ojiako *et al.*, 2008). Therefore, it is not guaranteed that the projects that get completed within time, cost and specified quality; will meet stakeholder satisfaction criteria of project success. It also has to meet the project KPIs thereby satisfying the project stakeholders to a large extent. Project success factors therefore, encompass achieving the key success indicators of the project which include: Timely completion of projects; on budget completion of projects; completion to specified quality; and completion to

stakeholders' satisfaction (Long *et al.*, 2004; Chan *et al.*, 2004; Jugdev and Muller, 2005). Achieving this depends on among other things, the level and effectiveness of stakeholder involvement at the inception of the project and how it is sustained through the project life cycle.

Stakeholder management has been recognised as an important strategy for achieving success in construction projects; therefore, effective framework for engaging/managing the stakeholders has to be developed. Moreover, satisfying the expectations of project stakeholders throughout the life cycle of the project is instrumental to the successful completion of construction projects (Atkin and Skitmore, 2008). Previous research efforts have investigated how stakeholder management in construction projects can be improved focusing on developing a comprehensive framework for carrying out stakeholder management. For example Chinyio and Akintoye (2008) established two approaches for stakeholder management: “*underlying*” and “*frontline*” approaches. Bourne and Walker (2005) developed a tool referred to as the stakeholder management cycle for identifying, visualising and mapping stakeholder influence on projects. And most recently, Yang *et al.* (2009) developed a framework for successful stakeholder management based on the groupings of the CSFs for stakeholder management. They argued that top management support is needed throughout the process.

Despite the increasing body of literature on stakeholder management in construction projects, it is widely acknowledged that there is still a need to develop a comprehensive stakeholder management framework (Cleland, 1999; Karlsen, 2002; Olander and Landin, 2005; Chinyio and Akintoye, 2008; Takim, 2009). The interactions between the CSFs for stakeholder management and what they ultimately aim to achieve (project success) appear to have been neglected. Furthermore, the causal relationships among the CSFs for stakeholder management have yet to be adequately addressed. This paper reviews the critical success factors for stakeholder management in construction projects and proposes a conceptual model as a first step for understanding the interrelationships between stakeholder management and construction project success.

Review on critical success factors (CSFs) for stakeholder management in construction projects

Critical success factors are “*areas, in which results, if they are satisfactory, will ensure successful competitive performance for the organisation; they are the few key areas where things must go right for the business to flourish*” (Rockart, 1979). Therefore, CSFs should be given constant and careful attention. Past studies (Jepsen and Eskerod, 2009; Olander and Landin, 2008; Chinyio and Akintoye, 2008; Jergeas *et al.*, 2000; Li *et al.*, 2011) have identified some factors considered to be critical to the success of stakeholder management in construction projects. It is however, observed that a more exhaustive identification as well as clearer understanding and modelling of the relationships among these factors and their grouping is necessary to further inform and equip industry practitioners to carryout stakeholder management. It is also observed from the extant literature on stakeholder management/engagement in construction, that the following factors have not been included in the most recent list of CSFs for stakeholder management in construction; although their importance have been raised: the procurement route adopted for the project (Love, *et al.*, 1998; Toor and Ogunlana, 2010); adopting flexible project organisation (Li *et al.*, 2011); the need to classify the stakeholders

(Bourne and Walker, 2005); analysing the change of stakeholders' interests (Freeman, 1984; Nash and Chinyio, 2010); and involving relevant stakeholders to redefine (refine) project mission when necessary (Akintoye *et al.*, 2003; Smith and Love, 2004; Winch, 2010). Adding these to the list of CSFs compiled from previous studies on stakeholder management in construction by Yang *et al.* (2009), a list of 20 CSFs is compiled as follows:

1. Clearly formulating the project mission;
2. Ensuring the use of a favourable procurement method;
3. Carefully identifying the project stakeholders;
4. Ensuring flexible project organisation;
5. Identifying and understanding stakeholders' interests;
6. Classifying stakeholders;
7. Exploring stakeholders' needs and constraints to projects;
8. Assessing the power, urgency, legitimacy and proximity (i.e. attributes) of stakeholders;
9. Assessing stakeholders' behaviours;
10. Predicting stakeholders' influence;
11. Analyzing possible conflicts and coalitions among stakeholders;
12. Compromising conflicts among stakeholders effectively (ensuring tradeoffs and no blame culture);
13. Keeping and promoting good relationships among the stakeholders and between the stakeholders and the project;
14. Analyzing the change of stakeholders' interests;
15. Analyzing the change of stakeholders' influence and relationship between them and the project;
16. Involving relevant stakeholders to redefine (refine) project mission;
17. Formulating appropriate strategies to manage/engage stakeholders;
18. Predicting stakeholders' likely reactions for implementing the strategy;
19. Communicating with and engaging stakeholders properly and frequently (instituting feedback mechanisms); and
20. Managing stakeholders with social responsibilities paying attention to economic, legal, environmental and ethical issues.

Using the critical success factors (CSFs) for stakeholder management in construction projects, few studies have been carried out to improve the process of stakeholder management in construction projects. These factors have been widely identified and acknowledged in past studies. They have also been empirically studied and grouped using factor analysis (Yang *et al.*, 2009) and structured in a hierarchical order grouping (Li *et al.*, 2011). Identifying the critical success factors for stakeholder management and grouping them as well as developing a hierarchical structure of them are good initial steps towards ensuring successful stakeholder management in construction project. This study uses the existing groupings of the critical success factors as enablers and project success/objectives as the goal of stakeholder management; to propose the conceptual model of stakeholder management process. This model is presented in the next section.

Discussion of model components and development of the model

Integrating the theoretical concepts of stakeholder management in construction project and project success, a conceptual model was developed to investigate the interrelationships among the CSFs for stakeholder management and the relationship

between CSFs and project success. The conceptual model is based on the following hypotheses with an underlying assumption that an effective stakeholder management process enhances the attainment of project objectives/success as shown in Figure 1:

1. Sustainable top management support facilitates adequate information gathering; informed stakeholder estimation and analysis and decision making; all of which drive effective stakeholder management process.
2. Adequate information on stakeholders leads to informed stakeholder analysis and the results of the stakeholder analysis could trigger the need for additional information on the project stakeholders.
3. Effective stakeholder management decision and strategy formulation is enhanced by well informed stakeholder estimation and analysis results.

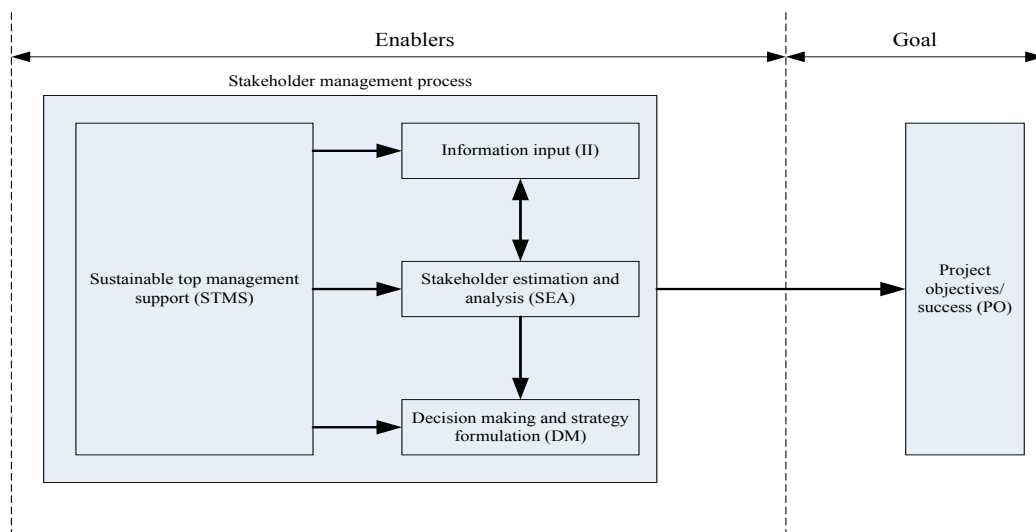


Figure 1 Conceptual model of stakeholder management: the relationship between critical success factors and project objectives/success.

As seen in Figure 1, the model proposes a direct relationship between the stakeholder management process and the project objectives/ project success. Project success is considered as the goal of stakeholder management process whereas information input (II), stakeholder estimation and analysis (SEA), decision making (DM) and sustainable top management support (STMS) are presented as the enablers. These four enablers of stakeholder management process are obtained using the CSFs for stakeholder management in construction projects introduced in section 2 and the grouping system introduced by Yang et al (2009) which was modified according to the aims of this research. Project objectives/success (PO) encompasses the key success indicators of the project introduced in section 1. The components of the conceptual model are discussed below with their respective indicators shown in detail in Table 1.

Sustainable top management support (STMS)

The STMS enabler informs and facilitates the achievement of a mission for stakeholder management in construction projects. This is enabled by the project top management commitment and direct or indirect involvement in ensuring that an effective stakeholder management process is developed and implemented throughout the project. Top management support will also ensure that the resources

needed to carry out stakeholder management are made available. Furthermore, this is vital because although project managers and other responsible professionals may be autonomous, they rely very much on the support of the head office to carry out their roles (Isik *et al.*, 2009). This is considered as fundamental to a successful stakeholder management process and is indicated by how managers monitor the change of stakeholders' relationships and influence, communicate with stakeholders properly and frequently and maintain a steady relationship with them throughout the project (Yang *et al.*, 2009). To achieve all these, top level management support is not only needed but so throughout the project (Chinyio and Akintoye, 2008).

Information inputs (II)

In order to inform a proactive decision in the stakeholder management process, it is necessary to obtain comprehensive information about the project and the stakeholders of the project. Detailed information need to be obtained about the project characteristics such as size, location, scope, type of client and political environment; and about the stakeholders characteristics such as their level power, interest, legitimacy and proximity (Winch, 2010; Mitchell *et al.*, 1997). This construct as hypothesised in the model is indicated by: Carefully identifying and making full list of project stakeholders; Exploring stakeholders' needs and constraints to projects; Clearly formulating the project mission; Ensuring the use of a favourable procurement method; Ensuring flexible project organisation; Identifying and understanding stakeholders' areas of interests; Considering social responsibilities (comprising; economic, legal, environmental and ethical issues) associated with the project.

Stakeholder estimation and analysis (SEA)

Stakeholder analysis enables an understanding of project stakeholders' interests and influence. Therefore, unless project stakeholders are carefully analysed in relation to their characteristics, their interests and associated issues may not be adequately addressed (Li *et al.*, 2012). Following the obtaining of sufficient and relevant information about the projects and its stakeholders, it is vital to be able to carry out rigorous stakeholder analysis and estimation of their respective level of interests and influence on the project. This construct is indicated by the following variables: Classifying stakeholders; Determining and assessing the attributes (power, urgency, legitimacy and proximity) of stakeholders; Predicting and mapping stakeholders' behaviours; Predicting stakeholders' potential influence; Identifying and analyzing possible areas of conflict and coalitions among stakeholders.

Decision making and strategy formulation (DM)

Based on the information and results of the analysis done of stakeholders' attributes and project characteristics, decisions are then made so as to manage stakeholders throughout the project. It is an important part of the stakeholder management process for decisions to be made on specific actions necessary to address identified stakeholder issues and to proactively avert any hindrances to the smooth running of the project (Chinyio and Akintoye 2008). The construct is indicated by: Resolving conflicts among stakeholders effectively (ensuring tradeoffs and no blame culture); Analyzing the change of stakeholders' influence and relationship among them and the project; Formulating/adopting appropriate approaches/strategies to manage/engage stakeholders; Predicting stakeholders' likely reactions for implementing the strategy.

Project objectives/success (PO)

The ultimate goal of any construction project is for them to be completed within budget, time, to specified quality and to stakeholder's satisfaction. For these to be achieved, the project execution process needs to be free from destructive conflict or with reduced conflict among the stakeholders and run as smooth as possible to completion (Toor and Ogunlana 2008). The project key performance indicators must also be met at all stages through to project completion and operation. It is assumed that these are achievable through an effective stakeholder management process which is the outcome of the combined relationships among the 'enablers' constructs. This construct is therefore indicated by timely completion of project; on budget completion of project; completion to specified quality; and completion to stakeholders' satisfaction.

Table 1 Model constructs and indicators

Constructs	Indicators
Sustainable top management support (STMS)	<ul style="list-style-type: none">• Keeping and promoting good relationship among the stakeholders and between the stakeholders and the project ;• Analyzing the change of stakeholders' interests and ensuring alignment with project goals;• Involving relevant stakeholders to redefine (refine) project mission;• Communicating with and engaging stakeholders properly and frequently (instituting feedback mechanisms);
Information inputs (II)	<ul style="list-style-type: none">• Clearly formulating the project mission;• Ensuring the use of a favourable procurement method;• Carefully identifying and making full list of project stakeholders;• Ensuring flexible project organisation;• Identifying and understanding stakeholders' areas of interests;• Exploring stakeholders' needs and constraints to projects;• Considering social responsibilities (comprising; economic, legal, environmental and ethical issues) associated with the project.
Stakeholder estimation and analysis (SEA)	<ul style="list-style-type: none">• Classifying stakeholders;• Determining and assessing the attributes (power, urgency, legitimacy and proximity) of stakeholders;• Predicting and mapping stakeholders' behaviours;• Predicting stakeholders' potential influence;• Identifying and analyzing possible areas of conflicts and coalitions among stakeholders;
Decision making and strategy formulation (DM)	<ul style="list-style-type: none">• Resolving conflicts among stakeholders effectively (ensuring tradeoffs and no blame culture);• Analyzing the change of stakeholders' influence and relationship among them and the project;• Formulating/adopting appropriate approaches/strategies to manage/engage stakeholders;• Predicting stakeholders' likely reactions for implementing the strategy;

Project objectives (PO)	<ul style="list-style-type: none"> • Timely completion of project; • On budget completion of project • Completion to specified quality • Completion to stakeholders' satisfaction
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The focus in this study is to propose a conceptual model of stakeholder management process showing the relationships between the enablers and goal of stakeholder management in construction projects. It is expected that the understanding of the hypothesised relationships among the constructs in the proposed model will enable a holistic stakeholder management process. In order to achieve this, it is necessary for this model to be tested using appropriate technique but that is not within the scope of the current paper.

Future research

Despite the continuous increase in research on stakeholder management in construction projects, there is still a need for a comprehensive framework for stakeholder management in construction projects that provides a step by step guide taking into account the interrelationships between critical success factors and the project outcomes. As part of an ongoing PhD research that focuses on this aim, this paper reviewed previous efforts aimed at improving stakeholder management process in construction projects and the perception of project success within the construction industry; reviewed the critical success factors and proposed a model for understanding the interrelationships between the CSFs for stakeholder management and project success in construction projects. Future research will focus on testing this model empirically in order to contribute to both knowledge and practice by showing the pattern and strength of the relationships proposed. It is currently proposed to adopt confirmatory factor analysis (CFA) to test the proposed groupings of the CSFs and then; structural equation modelling (SEM) to test the hypothesised relationships in the conceptual model due to its capability to simultaneously examine relationships among a number of dependent (latent) and independent (observed) variables. A questionnaire survey will be used to collect data from industry practitioners in the United Kingdom. Findings of SEM will be used to develop a comprehensive stakeholder management framework in the latter stages of the research.

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Business Model Reconfiguration in Green Construction: A Theoretical Perspective

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Abstract

Business models describe the business logic of a particular company and green business model is when a company changes part(s) of its business model and thereby both captures economic value and reduces the ecological footprint in a life-cycle perspective. In this paper, business model literature is reviewed with the intention of promoting learning to understand the economic complexity of environmental sustainability in the construction context. Although the green construction literature does not explicitly deal with the changes of construction companies business model, there is a considerable research that implicitly investigates features and elements of the business models of green construction. Key features from this literature are: green value propositions should always be related to customer/stakeholder issues. Going green will improve relationships among stakeholders and with particular customers since key activities are performed in a greener manner. Knowledge and partnership are the most important resources needed to go green and moreover green branding is an important resource and can be a source of competitive advantage. To unlock green value proposition opportunities, cost structure and revenue models should be considered from a long-term perspective.

Keywords

Business model, competitive advantage, green construction, green drivers, and sustainable construction.

1. Introduction

Changing attitudes toward greener growth and sustainable development potential in financial markets are classified as critical factors when assessing a company long-term competitiveness and profitability. It is anticipated that addressing the economic values of sustainable activities will motivate more and more companies to adopt sustainable activities. In addition, there is an increasing consensus that the sustainability agenda and green practices are in high demand in the construction industry not only for their return on investment, but also because being environmentally responsible can boost a project profile and a developer reputation, resulting in a market edge over competitors (Fehrenbacher, 2010). Consequently, new concepts have emerged to express sustainability in the construction context. These concepts include: green construction; sustainable construction; and ecological construction. Green construction refers to practices and processes that are environmentally friendly, resource efficient, energy efficient, and generated less waste (Arif, Egbu, Haleem, Kulonda, & Khalfan, 2009). Kibert (2004) defined

sustainable construction as “the creation and responsible management of a healthy built environment based on resource efficient and ecological principles.” For the purpose of the paper, sustainable construction or green construction can be used interchangeably (Kibert, 2007). Sustainable construction differs from conventional construction, in terms of the processes, designs, and materials used. Green construction adds tangible and intangible values to the construction services. The tangible values can be a higher profit as a consequence from lower internal costs, lower consumption of material, and resource efficiency while the intangible values can be a lower environmental impact, increased reliability, brand value, and reputation. In general, construction industry players who attempt sustainability have been strongly focused on environmental considerations (Guy & Kibert, 1998; Lützkendorf & Lorenz, 2005; Tan, Shen, & Yao, 2011).

To profit or capture value from green construction, the comprehensive alteration of the business models has to be at the heart because business models are at the core of shaping all company activities. However, it seems there are no explicit studies on what changes are common or required in the construction companies business models, when they are involved in green practices or projects. Therefore, this paper identifies and maps business model changes relative to green or sustainable construction through a review of literature, and reviews main drivers and benefits of adopting green construction. It is worth noting that “construction” here is used in a broader sense to include property development, construction companies, material suppliers, consultant, and design companies. Following this introduction, the reminder of this paper will be organised as follows: in Section 2 we present research method followed by literature review of the business model including definition and its relation to the strategy in Section 3. Section 4 presents a conceptual green business model and Section 5 reviews the green construction literature to explore how it deals with construction companies business model elements, when they go green. Finally, key issues from the literature are grouped together for conclusion and indicate future research in Section 6.

2. Method

This is a two stage literature review paper. Firstly, since the aim of this paper is to explore business models concepts, a review of the literature, across the disciplines of business and management, is conducted with the intention of understanding the economic complexity of environmental sustainability in the construction context. Key papers were identified using Google Scholar and Harvard Business Review databases in addition to the book entitled *Managing Green Business Model Transformations*. These were studied to understand the concept of business models and green business models in terms of important concepts and elements. These concepts and elements were subsequently used, in the second stage, to analyse relevant papers in green construction literature. Green construction literature was collected from Emerald “literature reviews collection” and EBSCO databases. The terms of “green construction” and “sustainable construction” were used to search in abstracts.

3. The Emergence of Business Models

In recent years, business model has been the focus of significant attention by both scholars and practitioners (Zott, Amit, & Massa, 2010). In general, they are using the term “business model” to express the business logic of a particular firm, the way

it does business, how it creates value for both its stakeholders and customers, and how it captures this value and turns it into profit (Aspara, Lamberg, Laukia, & Tikkanen, 2011; Baden-Fuller & Morgan, 2010; Chesbrough & Rosenbloom, 2002; Osterwalder & Pigneur, 2002; Teece, 2010).

3.1. Business Models and Strategy

The business model concept extends central ideas in business strategy and its related theoretical foundations. However, the business model needs to be distinguished from the business strategy (Sommer, 2012). Zott et al. (2010), identified two main differentiating factors between business models and strategy. Firstly, strategy is more concerned with competition, whereas the business model is more concerned with value creation, cooperation and partnership. In general, the business strategy of a firm focuses on value capture and competitive advantage, while the business model combines a focus on sustainable value creation and value capture. Secondly, the focus of the business model is on the value proposition with emphasis on the customer role, which is less evident in business strategy literature. According to Sommer (2012) the business strategy is a principle plan for the future success of a business in a dynamic and competitive environment. In contrast the business model can be viewed as a logic or blueprint for a strategy to be implemented through organisational structures, processes, and systems and thereby creating and capturing economic value. Therefore, the business model concept is important when translating business strategy into business processes. In addition, modern phenomena, such as globalisation and the sustainability movement have further contributed to the importance of the business model concept. A detailed definition of the business model is presented in the next section.

3.2. Business Model Definitions

Business model is a relatively new concept but it lacks a single definition, however, the agreed concept is related to value creation for customers and value capture. Therefore, business model promotes a dual focus on value creation and value capture (Afuah, 2004; Nielsen & Bukh, 2011; Osterwalder & Pigneur, 2002; Zott et al., 2010). A more detailed definition is provided by Slywotzky (1996) who sees the business model as the entirety of how a company selects its customer, differentiates and defines its offerings, defines the tasks it will deliver itself and those it will outsource, channels its resources, selects a market, creates value for customers, and captures value (profit). In summary, “A business model describes the rationale of how an organisation creates, delivers, and captures value.”(Osterwalder & Pigneur 2010).

4. A Conceptual Green Business Model

As management and economic sciences still lack a broadly accepted single definition of a business model, it comes as no surprise that theoretical research on green business models are few at this point in time (refer to Section 3 above for more details). However, there are two major works on green business models which based on extensive theoretical foundation and empirical data from different industries (for more detailed discussions see (FORA, 2010; Henriksen et al., 2012; Sommer, 2012).

Sommer (2012) suggested that the distinct common feature among all green business models is their advanced environmental performance – whatever form this

might take. In addition, he defined a green business model, as a business model that represents a significant improvement on the whole environmental performance relating to its entire value chain system, as compared to that of a conventional business model. This improvement is directly attributable to the business model through the different configuration and design of its elements. A similar definition and holistic perspective on green business model innovation is held by (Henriksen et al., 2012) who said “Green business model innovation is when a business changes part(s) of its business model and thereby both captures economic value and reduces the ecological footprint in a life-cycle perspective.” To develop the current understanding of green business model, the reduction of ecological footprint can include changes to firm products, services, processes, and policies, such as reducing energy consumption and waste generation, using renewable resources, and implementing environmental management system (Bansal & Roth, 2000). In order to develop a green business model, business model elements have to be defined and listed first. Osterwalder is one of the few authors who delivered comprehensive works on business models (Osterwalder, 2004; Osterwalder, Pigneur, & Tucci, 2005). The business model canvas tool, developed by the author (Osterwalder & Pigneur, 2010), is internationally acknowledged as a practical tool to analyse companies business models (see Fig.1. for details). It contains nine elements covering four main pillars of a business: the *Product* pillar describes what is offered to the customer; the *Customer Interface* pillar describes the customer and how the offering is delivered; *Infrastructure Management* deals with value creation aspects for the customer and can include value created internally or externally with aid of partners and finally the *Financial Aspects* pillar outlines how the company plans to make money with its business model.

Key Partners	Key Activities	Value Proposition	Customer Relationship	Customer Segment
	Key Resources		Channels	
Cost Structure			Revenue Streams	

Fig. 1. Business Model Canvas (Osterwalder & Pigneur, 2010)

As illustrated in Fig.1 above, the business model canvas gives a company a simple yet powerful tool to understand its current business model, in order to systematically challenge the ways it does business and thereby enables the company to think differently and create new alternative business models. According to Osterwalder and Pigneur (2010) key activities are defined as: activities that need to be performed to create customer value whilst key resources are the assets required to offer and deliver value to the customer. Afuah (2004), in his book on business models, regarded capability as an important element of the business model. He stated that capabilities are important because it usually takes more than resources or assets to offer value to customers. A firm capacity or ability to convert its resources into customer value (something that customers want) and then earn profits, is

usually called capability. Since this research is adopting a holistic view to develop a conceptual green business model, the capability element will be considered. Afuah categorised resources into three different groups: tangible, intangible, and human. Tangible assets can be physical, such as equipment or financial, such as cash: while intangible assets are nonphysical and nonfinancial such as brands, relationships with vendors, and knowledge, which can be excellent sources of profits. Human assets are the knowledge and skills that employees carry with them. The business model elements applied in this work can be found in Table 1.

Table 1: Business model elements applied in this work (Afuah, 2004; Osterwalder & Pigneur, 2010; Sommer, 2012)

No	Business model element	Description
1	Value Proposition	Gives an overall view of a company bundle of products and services that are of value to the customer.
2	Customer/ stakeholder segment	Describes the segment of customers/critical stakeholder whom a company wants to offer value to.
3	Relationship	Describes the kind of link a company establishes between itself and the customer/stakeholder.
4	Channels	Describes the means of getting in touch with the customers/stakeholder.
5	Key Activities	Outlines the most important activities need to be performed to create value to the customer.
6	Brand	The essence of a product or services: identity, reputation, image, intangible asset.
7	Employees	Human assets with their experience, training, relationships, knowledge, and insights are a crucial factor for any company.
8	Information	Can relate to any business model element to be of value and related to communication internally and externally. Examples include information on customer preferences, or the firm's environmental footprint.
9	Knowledge	Knowledge required by company managers and employees to realise their business models and strategies.
10	Technology	Can relate to both products and processes. It includes knowhow like patents or licenses, and the systems that a company uses to run its business model
11	Capability	The ability to execute the company business model or resources needed to turn concept into reality.

12	Partnership	A partnership is a voluntarily initiated cooperative agreement between two or more companies in order to create value for the customer. Allows companies to access external resources
13	Cost Structure	Describes the representation in money of all the means employed in the business model.
14	Revenue Model	Describes the way a company makes money through a variety of revenue flows.

5. Green Construction from a Business Model Perspective

Existing research shows that the construction industry is a major contributor to environmental problems, for example (McDonald & Smithers, 1998; Tam, Tam, & Tsui, 2004; Tan et al. 2011). Consequently, protecting the environment has become one of the main issues for the construction industry across the globe and the construction industry has begun to adopt environmental sustainability as a central part of its strategic business management. (Kjaerheim, 2005; Lozano, 2008; Park & Ahn, 2012). Evidence has shown that adopting an environmental approach leads to significant business benefits: for example, highly valuable green reputation, improved stakeholder relations between the demand and supply side, innovation opportunities, reducing life-cycle cost, efficiency, increased business productivity and achieving long-term profits (Bartlett & Howard, 2000; Hodges, 2005; M. Khalfan, 2000; Liu, 2006; Sacks, Nisbet, Ross, & Harinarain, 2012; Vatalis, Manoliadis, & Charalampides, 2011; von Paumgarten, 2003). Yet, despite all the ink spilt and words spoken, green values are still relatively poorly appreciated more widely in the construction context. For example, Abd. Hamid and Kamar (2012) state that one of the challenges of adopting sustainable construction is that companies do not know how to act upon the sustainability value “Although the values are generally at the right place, the problem is how to enact them.” This research suggests that the business model concept can be a means to resolve this challenge. Although construction literature does not specifically deal with changes to construction companies business models, there is considerable research that implicitly investigates features and elements of green construction business models (Mokhlesian & Holmén, 2012). The main features and elements of the business models, mentioned in green construction literature, are explained below.

The major drivers behind adoption of green construction are: legislative, ecological, social, and market drivers. (Refer to Table 2 for more details). These four groups of drivers, in particular, the market drivers, for example client requirements, have encouraged the construction industry to create green value propositions - their products or services are more environmentally sound when compared to conventional practices (Mokhlesian & Holmén, 2012). A company may derive a reputational value (*brand*) from green services, by changing the criteria that are most relevant to the customer through for instance, revised environmental processes and practices which both redefines the competition and helps customers to become green. Also cost savings, in the operational phase of a building with green features, have encouraged more stakeholders including clients to ask for green because they see a long-term economic benefit (Bartlett & Howard, 2000). *Green value propositions* are thus always associated with the *customer/stakeholder segment*. The *customer/stakeholder segment* represents the company choice of relevant groups

such as customers, regulators, and investors to which the company value proposition is intended to appeal: by offering superior value/ green differentiation to these defined groups, or by facilitating access to new target customers or by founding deeper customer *relationships* in particular with eco-minded customers (Pitt, Tucker, Riley, & Longden, 2009; Shen & Yu, 2012).

Table 2: Drivers of green or sustainable construction

No	Drivers	References	Categories of drivers
1	Climate change & Environmental degradation	(Arif et al., 2009; Isiadinso, Goodhew, Marsh, & Hoxley, 2011); Roberts and Sims (2008)	Ecological
2	Government & Environmental legislation	Qi, Shen, Zeng, and Jorge (2010); Isiadinso et al. (2011)	legislative
3	Managerial concerns	Fiedler and Deegan (2007); Chavan (2005); Qi et al. (2010)	legislative & Market
4	Stakeholder demands mainly clients	Qi et al. (2010); Pitt et al. (2009); Lorenz and Lützkendorf (2008); Fiedler and Deegan (2007); Chavan (2005); Walker (2000); Dainty and Brooke (2004)	Market
5	Cost savings	Dainty and Brooke (2004); Arif et al. (2009); Chavan (2005)	
6	Financial incentives & government fund	Pitt et al. (2009); Essa and Fortune (2008)	
7	Survival in the market	Zhang, Shen, Love, and Treloar (2000); Chavan (2005); Lorenz and Lützkendorf (2008)	
8	Social awareness	Lorenz and Lützkendorf (2008); Chavan (2005); Arif et al. (2009)	Social

The principal difference between green construction and conventional construction is that the former performs its *activities* in a more environmentally friendly manner by for instance, generating less waste, using renewable sources, and consuming less energy. For a construction company to perform in a greener manner it needs appropriate resources to do so. These resources can include: *knowledge*, *information*, *employee training*, *capability*, and appropriate *technology* to perform green activities. In particular, the literature emphasises the knowledge necessary to perform and achieve green practices. For example, Gluch, Gustafsson, and Thuvander (2009) investigated environmental knowledge needed for green

innovation in the construction industry. They suggested that companies can achieve green innovation through consideration of internal environmental knowledge sources and external knowledge exchange. Furthermore, the Construction Confederation Environmental Forum (CCFF) has six sustainability objectives. Of these, two objectives are related to knowledge “share and disseminate knowledge and best practice; increase environmental knowledge and skills in the industry by developing practical training tools” (CCEF, 2001). In a related vein, Alkhaddar, Wooder, Sertyesilisik, and Tunstall (2012) highlight the importance of raising awareness among construction employees on sustainability through deep learning approach and training. Different authors have mentioned that sustainability reporting (*information*) is increasing because companies are demanded by different stakeholders to demonstrate their commitment regarding sustainability issues (Kimmel, 2009; Pitt et al., 2009).

Partnership is a core theme in the construction research agenda (Dakwale, Ralegaonkar, & Mandavgane, 2011; Fiedler & Deegan, 2007; Ingirige & Sexton, 2006; M. M. Khalfan, McDermott, Li, & Arif, 2008) and it takes different forms (project-based, environmental collaboration and joint ventures) and names (alliances or collaboration). In addition, green construction literature highlights the importance of a collaborative approach. In a review of the literature on improving environmental performance of buildings, through increased energy efficiency, Dakwale et al. (2011) pointed out that in order to improve the overall environmental performance of a building: policy makers, architects, energy managers, construction managers, structural engineers, and consultants must work more closely and collaborate together. Additionally, the construction managers seek to collaborate with environmental groups because of pressures from stakeholders such as government. Another reason for such collaboration is the desire of a company to be associated with another company that has green reputation- *brand* (Fiedler & Deegan, 2007).

The *cost* element is frequently cited in green construction literature. The reason for this is likely to be due to the widely held belief that going green is associated with high cost (Vatalis et al., 2011). On the other hand, going green is a means of reducing the cost of capital by accessing public and private funding and it reduces the cost of running and maintaining the building over its life-cycle (Mokhlesian & Holmén, 2010). For this reason, life cycle cost (LCC) is frequently associated with environmental sustainability (Kloepffer, 2008). LCC is an economic model to evaluate a project life cycle. The objective of LCC analysis is to choose from a series of alternatives to attain the lowest long-term cost of ownership. Many companies in green construction realise substantial savings in internal cost structure, by implementing environmental improvement measures. Such improvements will lead to lower costs of compliance by reducing costs related to emissions; treatment costs and taxes, productivity developments, more efficient processes and new market opportunities which can also result in increased revenues (Lankoski, 2006; Nidumolu, Prahalad, & Rangaswami, 2009; Porter & Van der Linde, 1991, 1995; Sinclair-Desgagné, 1999). Consequently, the cost structure and revenue models have to be taken together - lower internal costs will lead to increased revenues.

6. Conclusion and Future Research

In this paper, business model literature has been reviewed with the intention of promoting learning into environmental sustainability in the construction context

from the perspective of economic considerations. The rational of this research focusing on the business models were the dual focus of the business models on value creation and value capture and its focus on the value proposition with emphasis on the customer role. This holds true for the construction industry because the customer/client is a main driver or trigger for a construction product. In addition, customer satisfaction, performances, and profitability are directly relevant to the construction industry. The business model concept will be useful in understanding how the construction companies deal with green issues. Key features from the literature are: (1) green value propositions should always be related to customer/stakeholder issues; (2) going green will improve relationships among stakeholders and with particular customers because (3) key activities are performed in a greener manner; (4) knowledge and partnership are the most important resources needed to go green and have received considerable attention from scholars; (5) the importance of collaboration with stakeholders inside (employees) and outside (customers and suppliers) the company (6) green branding is an important resource and can be a source of competitive advantage; (7) and to unlock green value proposition opportunities cost structure and revenue models should be considered from a long-term perspective.

It is proposed future research will be further carried out to review different business model elements with a view to developing a generic green business model. In addition, we will develop instruments for Phase 1 of data collection: pilot study. The pilot study will give directions on how to collect relevant data from construction companies for Phase 2 which is the main data collection phase.

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Sustainable Construction Capabilities: A Local Authority Perspective

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Abstract

The emerging trend of climate change adaptation in the construction industry has raised the need to identify the sustainability requirements of the construction industry. Considering sustainability has the potential to enhance company profiles and improve relationships with stakeholders particularly clients. This paper presents a case study of a Local Authority and sheds light on some major issues, drivers, benefits, and organisational changes associated with sustainable construction. In addition, it identifies the critical factors for successful sustainable practices. The findings reveal that the implementation of sustainable practices often demands significant organisational and management capabilities such as closer collaboration and joint work between internal units, sustainability experts, sustainability targets as well as collaboration between demand and supply sides. It is found that clients awareness and education are vital for successful sustainable construction.

Keywords

Clients education, collaboration, green credential, organisational structure, and sustainable construction.

1. Introduction

Climate change and its potential impact are gaining increasing attention globally. Thus, the topics of climate change and sustainability challenges are becoming a priority for governments, stakeholders, industry leaders, and companies (Sommer, 2012). This trend is also reflected in the increased communication about climate change as a new market driver (FORA, 2010).

The Building sector including homes and non-residential buildings (commercial and public) is responsible for 35% of UK total greenhouse gas emissions (GHG). The UK Green Building Council (UKGBC) has stated that the construction industry generates one-third of all waste in the UK and that 30% of emissions from operating buildings could be cut by cheap and simple measures (Alkhaddar, Wooder, Sertyesilisik, & Tunstall, 2012). According to the UK Committee on Climate Change (CCC), there are significant opportunities to reduce emissions from the building sector by improving energy efficiency, using low-carbon sources for heating, and decarbonising electricity supply. The construction industry can play a vital role in reducing such emissions (CCC, 2008).

The Department of the Environment, Transport and the Regions has set out a an industrial strategy for sustainable construction to be achieved by (DETR, 2000):

- i. being more profitable and more competitive
- ii. delivering buildings and structures that provide greater satisfaction, well-being and value to customers and users
- iii. respecting and treating stakeholders more fairly
- iv. enhancing and better protecting the natural environment
- v. minimising consumption of energy (especially carbon-based energy) and natural resources.

However, there is little explicit research that details the capabilities and management practices pertinent to effective sustainable construction practices. This paper addresses this gap by generating a better understanding of the characteristics of effective sustainable practices. More precisely, its purpose is: (1) to investigate organisational changes associated with sustainable construction, and (2) to identify organisational capabilities, success factors, and management practices necessary for the effective management of such sustainable practices. The remainder of this paper is organised as follows: Section 2 reviews sustainability literature, including main drivers, and benefits. Section 3 presents research methodology while Section 4 presents results and discussion. Section 5 reports conclusion and future research directions.

2. Literature Review

Although there are various definitions of sustainability, they have similar messages. It is generally agreed that sustainability has three basic aspects: namely, environmental, social, and economic. Some approaches focus only on the environmental or social or economic considerations, while others attempts to cover all three aspects simultaneously (Renukappa, Egbu, Akintoye, & Goulding, 2012). Sustainable construction is defined as a construction process that brings environmental responsibility, social awareness, and economic profitability to built environment strategies and practices (Essa & Fortune, 2008).

2.1. Environmental Aspects

The environmental aspects of sustainable construction have been gathering momentum in recent studies. Its impact can be summarised in the following areas:

1. Waste creation: negative impacts of waste creation are diverse including harming the surroundings by hazardous pollution, taking up land resources for waste landfill, and wasting natural resources. The UK government has introduced the Landfill Tax and Aggregate Levy to reduce waste generation. This legislation has encouraged major contractors to develop waste management policies and practices (Pitt, Tucker, Riley, & Longden, 2009).
2. Energy use: the construction of a building is an energy demanding process that consumes energy at each stage from site clearance to operation and maintenance throughout the life cycle. Improving the energy efficiency of the building results in reduced energy consumption and a reduction in carbon emissions ,a basic cause of environmental problems Reduced energy use ultimately improves overall environmental performance of the building. According to Pitt et al. (2009), the built environment is responsible for 50% of total UK energy consumption.

3. Water use: the construction industry can improve water usage in building by incorporating water efficient technologies such as low-water flush toilets and reduced flow taps. These measures can achieve an estimated 20% improvement in water efficiency (Pitt et al., 2009).
4. Pollution and bio-diversity: the Building Research Establishment (BRE) defined pollution from construction as “particles, noise, vibration and vaporous discharges.” Measures should be taken to eliminate this potential pollution. In addition, the construction industry should consider enhancing or at least better protecting biodiversity (Pitt et al., 2009).

2.2. Social Aspects

Social sustainability focuses on providing high customer satisfaction, responding to the needs of people, and working closely with employees, suppliers, clients, and local communities (Essa & Fortune, 2008). Companies are acknowledging their contribution to the social aspects of sustainability through Corporate Social Responsibility initiatives (CSR). According to Renukappa et al. (2012), CSR is a way of doing business that is based on ethical principles and a creation of positive impacts not only for financial shareholders, but for all stakeholders. It is worth noting that CSR is a voluntary action initiated by companies, however, delivery is not easy and requires a combination of factors.

2.3. Economic Aspects

The economic aspects of sustainable construction focuses on the importance of stable economic growth by using resources efficiently and adopting measures from fair and rewarding employment through to competitiveness and trade (Essa & Fortune, 2008; Pitt et al., 2009; Vatalis, Manoliadis, & Charalampides, 2011). There is an increasing consensus that companies can attract investment by focusing on sustainability issues. Considering sustainability has the potential to enhance a company profiles, improve the relationships with stakeholders, and improve perceptions of the construction industry among customers (Alkhaddar et al., 2012; Essa & Fortune, 2008; Fehrenbacher, 2010; Pitt et al., 2009; Roberts & Sims, 2008; Vatalis et al., 2011). In a related vein, (Hoti, McAleer, & Pauwels, 2005; Park & Ahn, 2012) stated that changing attitudes towards greener growth and sustainable development potential in financial markets are critical factors when assessing companies long-term competitiveness and profitability. From the literature, some emerging economic concepts can be summarised: integration of short-term return and long-term profits, value for money, green value, improved efficiency measures which means maximum output with minimum input, stakeholder collaboration between demand and supply sides, and business pattern changes from a linear process to a cyclic process (Khalfan, 2000; Revell & Blackburn, 2007; Vatalis et al., 2011).

2.4. Drivers of Sustainable Construction

Prior research on sustainable construction has identified three principal driving forces: legislation, market, and ethical motives, as illustrated in Fig.1. The importance of legislation in inducing sustainable construction has been widely recognised (Arif, Egbu, Haleem, Kulonda, & Khalfan, 2009; Isiadinso, Goodhew, Marsh, & Hoxley, 2011; Liu, 2006; Qi, Shen, Zeng, & Jorge, 2010). Fiscal incentives, penalties, and legal costs have punctuated the importance of complying

with legislation. In addition, companies can avoid costly capital refits by keeping ahead of legislation (Bansal & Roth, 2000).

Market drivers have also been instrumental in inducing sustainable construction. For example, stakeholders, mainly clients, increasingly require the supply side to adopt sustainable policies and practices in the construction processes (Bennett & Crudgington, 2003; Engineers, Parkin, Sommer, & Uren; Holton, Glass, & Price, 2008; Qi et al., 2010; Tan, Shen, & Yao, 2011), and achieve cost savings through reduction in energy costs and waste minimisation (Arif et al., 2009). Moreover government funds can be obtained by adopting sustainable construction agendas (Essa & Fortune, 2008) and revenues can be improved through new green marketing opportunities (Bansal & Roth, 2000).

Currently ethical motives are also a key driver for companies to move towards sustainable construction. For example, climate change and environmental degradation have encouraged companies to be ecologically responsible. CSR and increased social awareness are instrumental in encouraging companies to evaluate their role in society (Akadiri & Olomolaiye, 2012; Arif et al., 2009; Chavan, 2005; Fiedler & Deegan, 2007).

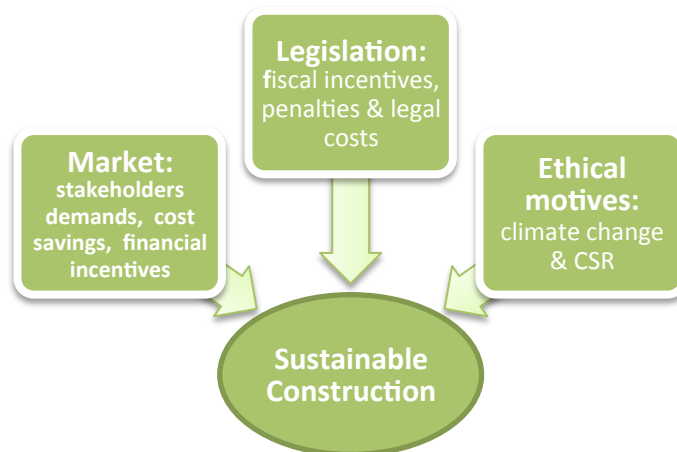


Fig. 1. Drivers of sustainable construction

Fig.1. summarises the driving factors of sustainable construction. This suggests that construction companies adopt sustainable practices to comply with legislation, to acquire market benefits including competitive advantage, and to improve ecological and social balance.

2.5. Benefits of Sustainable Construction

- 5 Existing research shows that sustainable construction has significant business benefits: for example, a highly valuable green reputation, improved stakeholder relationships, innovation opportunities, reducing life-cycle cost, improved efficiency increased business productivity and achieving long-term profits (Arif et al., 2009; Bartlett & Howard, 2000; Hodges, 2005; Khalfan, 2000; Liu, 2006; Sacks, Nisbet, Ross, & Harinarain, 2012; Vatalis et al., 2011; von Paumgarten, 2003).

The Dow Jones Global Sustainability Index (DJGSI) tracks the financial performance of world leading sustainability-driven companies. According to Tan et

al. (2011), DJGSI companies have outperformed the standard Dow Jones Global Index by 15% per year over the period 1994-2000. Elsewhere the FTSE4Good index rates companies on their environmental and social performance. FTSE4Good companies achieve better performance than conventional FTSE100 companies historically (Tan et al., 2011). Such notions demonstrate the positive relationship between sustainability practice and business performance thus leading to improved investment opportunities.

3. Method

This paper presents an exploratory case study into capabilities and opportunities of sustainable construction through a semi-structured interview with a senior Local Authority officer to shed light on some of the major issues, drivers, benefits, and organisational changes associated with the implementation of sustainable construction in the UK.

The interview consisted of two main sections. The first section covers general information about the interviewee such as job title, responsibilities, and their experience in environmental sustainability issues. The second section included 9 open-ended questions, to allow for probing and comment on issues brought up during the interview. The interview lasted for almost 1 hour in the interviewee workplace. For the purpose of this paper, we will present only the results of 6 questions:

- 1) What are the critical factors that drive your organisation to adopt green practices?
- 2) What are the greatest benefits to your organisation in addressing green issues?
- 3) What are the major green issues facing your organisation?
- 4) What changes occurred in your organisation when implementing green practices and why?
- 5) What conditions changed or need to change for successful green practices?
- 6) What organisational and management capabilities are most important for green practices?

4. Results and Discussions

This Local Authority is from a major economic city in the UK, with a population of 212,125. The Authority has advanced sustainability agendas and an ambitious vision to stay at the forefront of future planning. A senior officer of the Local Authority was interviewed to capture the policy maker perspective. The interviewee has 34 years experience with the Local Authority and currently is Corporate Asset & Capital Manager where the responsibilities are: asset management, energy management, and design and procurement management. The interviewee regarded himself as an individual with reasonable environmental sustainability experience but noted that some members of his team were experts in environmental sustainability. From his perspective, the critical drivers of green practices in a local authority context were (in order):

1. Climate change and environmental degradation: a local authority should be seen as a leading in these issues.

2. Cost savings: publically funded bodies are facing cost pressures, such as fuel and energy costs, therefore encouraging the introduction of different green initiatives.
3. Social awareness: major issues are faced such as reducing fuel poverty – for instance the Authority has set up a joint venture company to install a combined heating and power (CHP) network. 3 CHPs plants have been installed, at the moment, to reduce energy costs for council houses and some public buildings.

Surprisingly, legislation was not seen as a critical driver. The interviewee said that although Authority has to comply with legislation such as carbon tax and carbon reduction commitment (CRC), even in the absence of such legislation the Authority would adopt green practices for the above reasons.

“We will still make every effort to reduce our energy usage and our carbon footprint because of cost saving, climate change, and social awareness. Environmental legislation is something in the background but not a major driver.”

The greatest benefits in addressing green issues were:

1. Green credentials: reputation is important for the Authority - it needs to be seen as having engagement in green issues and to show a good example for others.
2. Innovation: the introduction of CHP plants and hydrogen buses in the city, were green initiatives, which were innovative.
3. Efficiency: with limited financial resources, the Authority needs to manage in the best way possible. Energy efficiency is one of the primary aims.
4. Reducing life-cycle cost: the asset management plan is to carry out a life-cycle cost exercise to take decisions on public buildings, either to keep and manage them if it affordable to do or close them down if the operational cost is too high.
5. Achieving long-term goals: such as carbon reduction and energy savings.

The interviewee said that energy is the major green issue facing the Local Authority in terms of both cost and security. The primary aim is to reduce energy costs. To improve energy security, the Authority is trying to develop an energy delivery model which aims to decentralise the energy source and have different energy sources for different areas of the city. For example, areas with CHPs plants and areas with renewable energy from off-shore wind farms - however, this model still in the planning stage.

“The more we can become self reliant in energy with initiatives we introduced, the better it will be from our point of view.”

A change brought by implementation of green practices is closer working relationship, between team members, so as to incorporate green issues from the earliest design stage - the design team and the energy team work in the same section. Previously the design team would take on board the installation of renewable energy systems without the experience of the energy team. The close work between asset management and energy team has resulted in identifying inefficient buildings - energy usage of a building is among the assessment criteria to decide which buildings will be kept open and which will be closed down. The

interviewee explicitly highlighted the importance of integration of green issues from an early stage in order to deliver better results, specifically the interviewee answer was:

“The earlier the better, adding something later almost like decoration or on the surface is not the way to go. Energy savings should not always result in additional capital costs. Basics such as orientation of building and specification of insulation, and things like that, all impact the cost.”

This discussion has some support in the literature. Essa and Fortune (2008) support the early consideration of sustainability in a project life cycle which is likely to result in less of an increase in capital costs than those projects in which decisions of sustainability issues were made at a later stage.

The interviewee believed that the reputation of the city has been enhanced by green initiatives and the implementation of green practices. For successful green practices, the basics have to be backed by all parties, the design side and the user side. Also clients education is important to demonstrate the benefits of such green practices. This view resonates with the literature on clients as the key driver towards sustainable construction. Raising clients awareness is crucial to move away from predominantly short-term financial decision making (Alkhaddar et al., 2012; Chavan, 2005; Pitt et al., 2009; Renukappa et al., 2012). Implementing a successful green agenda and practices often demands significant organisational and management capabilities, which include:

1. Closer collaboration and joint work between different units of the local authority.
2. Experts within each of the teams, with relevant experience in green practices.
3. Setting clear and reasonable goals to be achieved by each team (asset team, design team, and energy team) with an agreed annual team plan. For example, the energy team has set a goal to reduce CRC. To achieve this goal, they are trying to ensure energy usage is reduced by 10-15% annually. Additionally, the council saved almost £1 million in water costs as a result of adopting efficient water usage initiatives. A reduction of fuel poverty is also part of the team plan.

The interviewee concluded that management and organisational structure have changed significantly since the implementation of green practices. This view is echoed in other findings in companies in which sustainability practices contributing to profits are called “Harvesters.” This reported lessons learnt such as : Harvesters usually change the organisational structure or adopt new structures and establish the position of sustainability officer; Harvesters become more collaborative with stakeholders inside and outside of the company; finally, Harvesters change their business model (Kiron et al., 2012).

6. Conclusion and Future Research

Sustainability considerations have the potential to enhance company profiles and improve the perception of the construction industry among clients. However, few studies have investigated the capabilities needed for sustainable construction. This paper has presented a case study of a Local Authority on organisational changes, successful factors, drivers, and benefits associated with adopting sustainable

construction. The findings reveal that the management and organisational structure changed significantly in terms of closer joint work, between internal units, to incorporate green issues from an early design stage and the presence of sustainability experts in teams to provide the appropriate guidance. In addition the case study shows that collaboration between supply and demand sides and clients awareness are crucial for successful sustainable construction. The importance of clients awareness is further supported by the realisation that clients are one of the major stakeholders in the construction industry and that clients normally trigger the design and production of construction facilities. Moreover, setting sustainability targets as a strategy and updating them is another key success factor highlighted by the case study.

Further research will be carried out to identify the key resources and capabilities needed for sustainable construction. Data will be collected from construction-related companies in order to examine the fundamental changes with regard to adopting sustainable construction practices.

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Empowering Local Governments in Making Cities Resilient To Disasters: Case Study as a Research Strategy

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Abstract

The paper intends to elaborate the research methodology adopted for a doctoral research study aimed at developing a framework to empower the local governments to make cities resilient to disasters in the built environment context. Based on the constructionism epistemological undertaking and the theoretical perspective of being interpretivism in nature, the research would fall under the category of qualitative research. Therefore, qualitative strategies are best suited for conducting this study. Various research strategies exist for qualitative research, such as case studies, ethnography, grounded theory and phenomenological research. The research seeks to investigate how local governments can be empowered to make cities resilient to disasters in the built environment context, and out of the available qualitative research strategies, case studies have been identified as the most appropriate research strategy for the research discussed in this paper. The paper compares and contrasts the available research strategies and claims the suitability of the case study research strategy, in achieving the aims and objectives of the research. In doing so, the paper outlines the inherent components of the methodology namely, research philosophy, approach, strategy, choice, time horizon and techniques while justifying the suitability of the selected methodology through various research methodology literature.

Keywords

Case study, Disaster, Local Government, Research methodology, Resilient cities

Introduction

Research methodology can be identified as the basis by which to direct the research to the right path. It informs the philosophical underpinnings, research strategy and choice of data collection and analysis. Methodology varies according to the research problems investigated and therefore identification of the most appropriate research methodology is essential to achieve the aims and objectives of the research and to ascertain the credibility of the research findings. Therefore selection of an appropriate research methodology is one of the fundamental aspects of any doctoral research study to ensure the reliability of the research findings. As such, the paper aims to elaborate the research methodology adopted for a doctoral research study aimed at developing a framework to empower the local governments to make cities resilient to disasters in the built environment context.

The paper first discusses the process of establishing the research problem. Then the paper discuss in detail the research philosophy, research approaches, research

strategies, choices of methods, time horizons and techniques and procedures while adopting Saunders *et al.* (2007) research ‘onion’ as a guideline.

Establishment of the research problem

A research is a systematic and methodical process of enquiry and investigation with a view of increasing the knowledge domain (Collis and Hussey, 2009). At the outset of any research, it is important to find an acceptable focus for the study which in turn requires continuous focusing and re-focusing (Easterby-Smith *et al.*, 2008). In this research the initial focus has been defined based on the researcher’s area of interest and the research problem has been established based on reviewing of relevant literature and expert opinion. Many authors, for example, Saunders *et al.* (2007); Remenyi *et al.* (1998) were on the agreement of the need for selecting a research area which matches the strengths and interest of the researcher. As such it is important to select an area which the researcher is particularly interested and capable of. Adding to those, Saunders *et al.* (2007) further highlighted the need of considering, achievability within the available time, relevance at the time of finishing the research, achievability within the available financial resources, access to data sources and appropriateness of conducting the research. Accordingly, the initial interest of the field of research came from the researcher’s own expertise and interest. Thus the subject area has been defined as “making cities resilient to disaster”.

A critical literature review has then been conducted to establish the research problem of the study. The main purpose of the critical literature review is to develop a good understanding and insight into relevant previous and current research in the field of study (Saunders *et al.*, 2007). Moreover, the literature review process involves identifying gaps in the existing research. In other words, a strong literature review is the basis for sound empirical research which helps to identify the research gap and to suggest research questions that address the gap (Eisenhardt and Graebner, 2007). Through the initial review of literature, it was able to recognise local government as one of the key stakeholders in making cities resilient to disasters. Although local governments have been identified as a key stakeholder in the process of making cities resilient, with the initial literature review it was able to identify several gaps in the contributions made by local governments in making their cities resilient. As such, the critical review of literature has helped to refine the initial research ideas and to gain a thorough knowledge in the area of research. As Easterby-Smith *et al.* (2008) mentioned, the review remains as an ongoing process which requires refinements and modifications as the study progresses. This is because new findings emerge all the time and it is important to reflect the new findings. Also, adjustments to initial arguments might require if the empirical findings lead the research in a new direction (Easterby-Smith *et al.*, 2008). Having carried out a critical review of literature, the researcher was able to establish the research problem, the aim and the objectives of the study and was able to develop the initial conceptual framework. These were further refined based on expert opinions.

Unstructured interviews were carried out with three experts who are extensively involved in the disaster management field of study and based on their opinion the research problem has been refined and the aim, objectives and conceptual framework has been further refined to reflect the refined research problem. The next

section highlights the research problem which have been established and refined through this process.

Research problem

The world is experiencing rapid urban growth with a consequential increase in urban poverty. As a result of rapid urbanisation, the world's population is increasingly concentrated in large cities with poor housing and lack of basic protective infrastructure (Red Cross, 2010; UN-ISDR, 2010). This excessive unplanned urban growth leads to various physical, social and economic vulnerabilities. Consequently, the impacts of disasters are highly detrimental when they occur in urban environments. According to the Red Cross (2010) more than fifty percent of the world's population lives in cities and urban centres, increasing the risk of informal settlements, social inequality and environmental degradation, making them more vulnerable to disasters. It is therefore important to strengthen these urban cities by increasing a city's resilience to disasters. The built environment provides a core to many human activities and plays a critical role in every city. Thus, when moving towards sustainable urbanisation and safer cities, it is necessary to develop the built environment with an effective degree of resilience, in order to withstand and adapt to the threats of disasters (Bosher, 2008).

A large number of stakeholders need to become involved in the process of making resilient cities, following which local governments are required to play an essential role as they are the main governing body in every city. Several authors, as well as institutions such as UN-ISDR, have identified local government as one of the key stakeholders in the process of making cities resilient. Some have argued that local authorities are the vehicles through which the disaster risk agenda could be championed as they are rooted in the local communities where disasters happen (Manyena, 2006). As such, a resilient city needs to be able to deal with any impending hazard locally and the local governments being the main governing body in every city, are expected to undertake the responsibility of managing the situation in their respective cities. Due to this emerging need to empower local governments to implement disaster risk reduction measures, UN-ISDR has specifically addressed the 2010-2011 world disaster risk reduction campaign to local governments under the theme of "Making Cities Resilient – My City is Getting Ready". While further recognising the importance and long term nature of the campaign it has been further extended until 2015.

Even though there is a growing concern among researchers and practitioners about the role of local government in making cities resilient, several incidents have been reported on the inadequate contribution of local governments in taking the lead role in disaster risk reduction initiatives. Pearce (2003) has identified that some local governments do not include or work with people and this has made it difficult to make decisions and provide reasonable solutions for disaster related problems. According to Manyena (2006), the development of disaster resilience by local authorities is largely dependent on the capacity of local authorities to plan and manage the development activities. As such strengthening of local government should be a primary concern of policy makers (Pelling, 2003; Dillinger, 1994; Abbott, 1996; Schubeler, 1996). This emphasises the need to develop the capacity of local governments in order to implement proper disaster risk reduction within the areas under their jurisdiction. Therefore it is important to identify the challenges faced by local governments in implementing disaster risk reduction initiatives and

to understand how local governments can be empowered and governance can be reformed to ensure successful implementation of disaster risk reduction initiatives at the local level. As such the empowerment of local government in making cities resilient to disasters emerges as a very important research area in today's context with much potential.

Even though much research is available on the role of local government in disaster risk reduction and making cities resilient, there is a gap in research yet to be filled on how local governments can be empowered to take up a lead role in successful implementation of disaster risk reduction initiatives in their respective local areas. Several authors have identified the importance of good governance in disaster risk reduction, but how good governance could be incorporated at local governmental levels to make cities resilient has not been clearly addressed through academic research. Hence there is a need to undertake research on how local governments can be empowered to take a leading role in making cities resilient to disasters through reformation of the existing governance structure. Consequently, the aim of this research is to develop a framework to empower local governments to make cities resilient to disasters in the built environment context. In order to achieve this aim the research objectives and research questions have been formulated.

The research questions are the key issues that will be addressed through the research process. Hence, in achieving a greater focus, the researcher has established a number of research questions. Key questions are listed below.

- How could local governments be empowered to take a leading role in making cities resilient within the context of the built environment?
- What are the weaknesses of the existing local governance structure in relation to making disaster resilient cities?
- How could the local governance be restructured to ensure an effective commitment in making cities resilient within the context of built environment?

Sri Lanka was severely affected by the Indian Ocean Tsunami in 2004 and also with serious floods at various times. The Joint Report of the Government of Sri Lanka and Development Partners, issued in December 2005, highlights that the 2004 tsunami caused the death of 35,000 people and destroyed US \$ 900 million worth of assets and infrastructure in Sri Lanka. More recently, during early months of 2011, Sri Lanka has been severely affected by floods and the lives of many people have been disrupted, as well as many rice crops destroyed (Reuters, 2011). During the event at least 57 people were killed, around 193,700 were affected and at least 35% of rice crops were destroyed. As a developing country which is prone to natural disasters caused by floods, cyclones, landslides, droughts, coastal erosions and also to low-frequency and high impact events like tsunamis (DMC- SL, 2005), Sri Lanka is vulnerable to disasters and is in great need of disaster resilient cities. On the other hand, according to the report on climate change vulnerability in Sri Lanka, the country is experiencing rapid urbanisation where it is estimated that the percentage of urban population would rise to 50% in the year 2016 (Ministry of Finance and Planning, 2006). Furthermore, in 2009, the manufacturing, construction, and services sectors, which are primarily urban-based, accounted for 83.3% of GDP (Climate Change Secretariat, 2010). This clearly indicates that the majority of economic activities of the country are taking place in urban areas and are not distributed geographically, making the country more vulnerable to disasters. Thus,

Sri Lanka, being a country experiencing rapid urban growth and being vulnerable to various natural disasters, provides a sound basis for this research and hence the scope of the research will be focused on Sri Lanka.

Research methodological design

A research design is “*the logic that links the data to be collected and the conclusions to be drawn to the initial questions of a study*” (Rowley, 2002). The methodological design of this research has been structured based on Saunders *et al.* (2007) research ‘onion’ which is depicted in Figure 1. This provides guidelines to select the most appropriate research methodology. The research ‘onion’ has six layers, each of which indicates an important aspect which need to be looked at when deciding an appropriate methodology. According to Saunders *et al.* (2007), each of these important layers need to be peeled away before coming to the central point which is, data collection and analysis. Accordingly, the subsequent sections illustrate the research methodological design of the research based on Saunder *et al.* (2007)’s research ‘onion’.

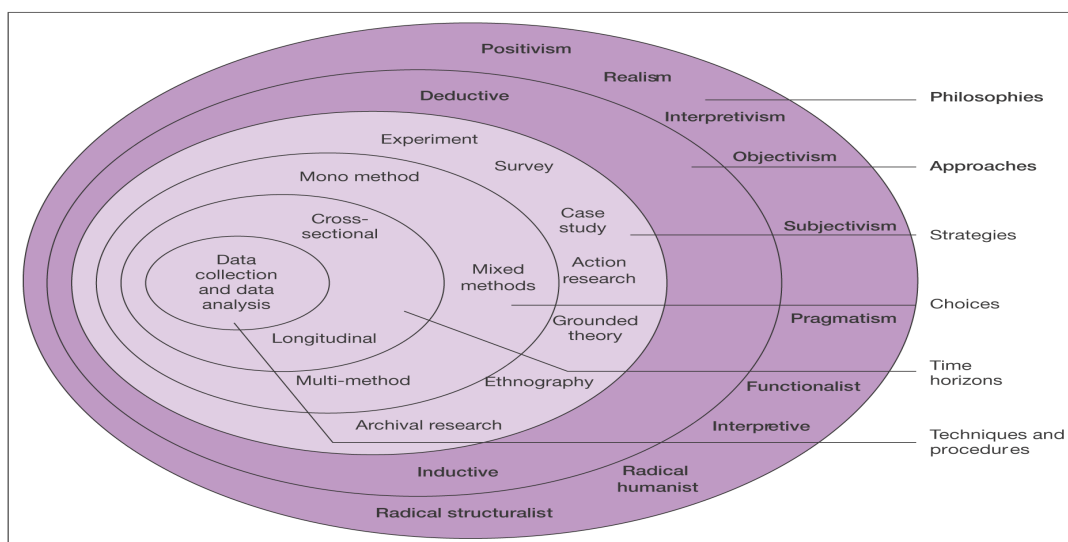


Figure 1: The research ‘onion’ (Source: Saunders *et al.*, 2007)

6 Research Philosophy

The research philosophy contains important assumptions about the way in which the researcher view the world (Saunders *et al.*, 2007). These assumptions will underpin the research strategy and the methods chosen as part of that strategy (Saunders *et al.*, 2007). While recognising the importance of research philosophy, Easterby-Smith *et al.* (2008) claim that they are central to the notion of research design and failure to think through philosophical issues can seriously affect the quality of research. The next section explains the three major ways of thinking about the research philosophy: epistemology, ontology and axiology.

Epistemology

Epistemology is concerned with what constitutes acceptable knowledge (Saunders *et al.*, 2007; Collis and Hussey, 2009). In other words, it is concerned with what we accept as valid knowledge (Collis and Hussey, 2009). The aim of this research is to develop a framework to empower local governments to make cities resilient to

disasters in the built environment context which would be achieved by way of developing the capacities of local governments and by reforming the governance structure. Therefore, in this research, the researcher has more authority over the data collection as no external reality has existed and there is no objective truth. Therefore the research will fall under the view of a constructionism perspective, which argues that there is no meaning without a mind and the truth or the meaning comes into existence in and out of our engagement with the realities in our world (Crotty, 1998). This is also known as social constructionism and considers that the reality has been socially constructed (Saunders *et al.*, 2007). As such, different people may construct meanings in different ways even in relation to the same phenomenon (Crotty, 1998). In terms of empowering local governments to make cities resilient to disasters, the researcher is deemed to be a part of the research and the reality is determined by people rather than by objectives and external factors, and this is a core element of social constructionism as explained by Easterby-Smith *et al.* (2008). Therefore constructionism can be identified as the best way of enquiring into the research question.

Ontology

In addition to the epistemological positioning, ontological assumptions represent another important part of the research. Ontology is the study of being (Crotty, 1998), and concerned with the nature of reality, and raises the question as to what assumptions we would have to make about the way in which the world works (Saunders *et al.*, 2009). In other words, it is the philosophical assumption about the nature of reality (Easterby-Smith *et al.*, 2008). There are two ontological assumptions namely, realism and nominalism considering the nature and the structure of the social and organisational reality (Johnson and Duberly, 2000; Burrell and Morgan, 1979). Realists assume that the external world has a pre-determined nature and a structure and reality exist independently of human consciousness and cognitions. In contrast, nominalists assume that reality is a product of our minds where different observers may have different viewpoints.

This research is expected to explore the ways in which local governments could be empowered to make cities resilient to disasters within the context of built environment. In addressing this, the meaning given to resilient cities and the ways of empowering local governments does not have a pre determined nature and a structure and the truth could be varied upon the place and time and on the viewpoints of the observer. Therefore within the two extremes, the intended study could be positioned more towards the nominalism stance.

Axiology

Axiology is another branch of research philosophy which explains the value system. The researchers are demonstrating their values such as personal values, feelings and beliefs, which would create a part of the research philosophy throughout the research process. Axiology can be classified into two opposing views, i.e., whether the reality is value free or value laden. This research could be identified as value laden research where the choice of research area, formulation of research questions, choice of methods, formulation of research design and data collection techniques, implementation of data collection, analysis of data, interpretation of data and conclusions would be intruded by values that the researcher holds (Bryman and Bell, 2003).

Having identified the epistemological, ontological and axiological assumptions of the research and the fact that the research is socially constructed and value laden, it is important to further look into the theoretical perspectives which govern the research philosophy. According to Crotty (1998), the theoretical perspective provides the philosophical stance informing the research strategy and thus providing a context for the process and grounding its logic and criteria. The main focus of this research is to develop a framework to empower local governments to make cities resilient to disasters which is a complex issue and which cannot be theorised by definite laws as physical sciences (Saunders *et al.*, 2009). Therefore the theoretical perspective which governs this research has been positioned towards an interpretivist stance. According to Saunders *et al.* (2009), interpretivism, which is an attempt to make sense of the world around us, is highly appropriate, particularly in the fields such as organisational behaviour. This would facilitate the study of the existing structure and the governance arrangements of local governments with a view to understand and explain what is going on.

Research approaches

Research approach is concerned with the use of theory. Saunders *et al.* (2007) identified two main research approaches: deductive and inductive. Deductive approach is about developing a theory and hypothesis and design a research strategy to test the hypothesis. Inductive approach is about collecting data and developing theory as a result of the data analysis.

As shown in Figure 2, two main principles of research are involved: namely, the research in the explanatory sciences and research in the design sciences. The first three phases of the research process are under explanatory science where the core mission is to develop valid knowledge to understand the social world or to describe, explain and predict the existing state of the social world (Aken, 2005). According to Vaishnavi and Kuechler (2004) all designs begin with an awareness of a problem and therefore design research is also known as ‘improvement research’ which highlights the problem solving and performance improving nature of an activity. As such, the intention is to study the current practice of local governments in making cities resilient to disasters. This will develop knowledge on existing barriers faced by local governments and would help to explore good practice in the field concerned. Having identified the problem, the suggestions for the problem solution are drawn from the existing knowledge/theory base. In this research, the suggestion would be to develop a framework to empower local governments through reformation of the governance structure.

Accordingly, the next three phases of the research process could be categorised under design science, where the core mission is to develop knowledge that could be used by the government to design solutions to their field problems (Aken, 2005). The development of the framework will fall under design science where an attempt is made to develop an artifact according to the suggested solution.

Explanatory sciences and design sciences both play an important role in this piece of research where explanatory science would lead to understanding the nature and the causes of the problem, and would be helpful in designing solutions. On the other hand, design research would lead to the development of the solution itself (Aken, 2005). A fully and partially developed framework would then be validated to evaluate the applicability to the research problem. Development, evaluation, or in

this case validation and further suggestions, would frequently be performed in the course of the design effort (Vaishnavi and Kuechler, 2004), and finally the recommendations would be generated. Accordingly, the research will use an inductive approach and will develop a theory (framework) as a result of the data analysis.

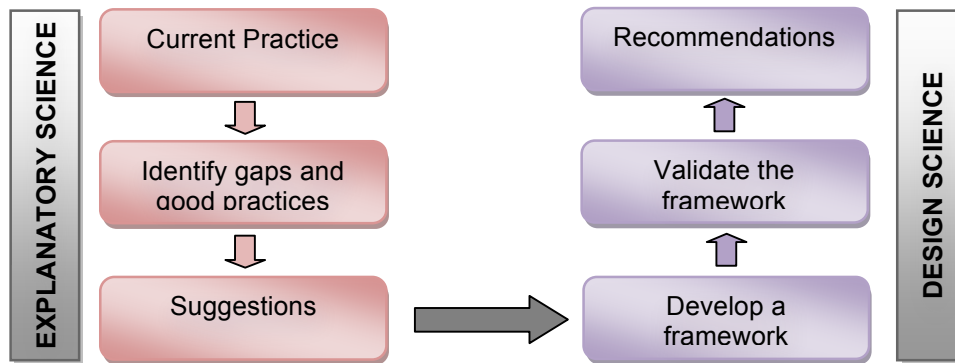


Figure 2: Research process

Research strategies

Rationale for selecting case study research

There are a number of different research strategies such as, experiment, survey, case study, action research, grounded theory, ethnography and archival research. A research strategy like experiment is not applicable to this study as the researcher does not have a control over the phenomenon being investigated. Experimental studies are concerned with looking at the relationships between two or more variables (Saunders *et al.*, 2007). It attempts to manipulate independent variables to observe the effects on the dependent variables (Collis and Hussey, 2009) which are not particularly applicable in this scenario. As discussed under philosophy and approach, this research is governed by interpretivism stance and uses an inductive approach. As such, strategies like surveys are also not associated with this research, as survey strategy is normally used in deductive research (Saunders *et al.*, 2007), and positivist studies (Collis and Hussey, 2009).

Further, based on the constructionism epistemological undertaking and the theoretical perspective of being interpretivism in nature, the research would fall under the category of qualitative research. Therefore, based on the philosophical stance of the research, qualitative strategies are best suited for this study. The qualitative research normally emphasises the words rather than quantification in the collection and analysis of data (Bryman and Bell, 2003). As a result, the research would lead to generation of a theory as the outcome of the research. According to Creswell (2003), five main strategies of enquiry in relation to qualitative research would exist. They are ethnography, grounded theory, case studies, phenomenological research and narrative research. These strategies are summarised below.

Ethnography: where the researcher studies an intact cultural group in a natural setting over a long period of time by observation.

Grounded theory: where the researcher attempts to derive a general abstract theory of a process, action or interaction grounded in the views of participants in a study.

Case studies: where the researcher explores in depth a programme, event, activity or a process of one or more individuals.

Phenomenological research: where the researcher identifies the human experiences concerning a phenomenon as described by the participants in a study.

Narrative research: where the researcher studies the lives of individuals and stories about their lives and then it will be retold or restructured by the researcher in a narrative chronology.

The aim of the current research is to develop a framework to empower local governments to make disaster resilient cities within the context of the built environment by way of developing their institutional capacities and providing more authority and resources through reforming the existing governance structure. As such, phenomenological and narrative research would not be relevant to this piece of research as they are more towards identifying human experiences and studying the lives of individuals. Similarly, ethnography is about describing and explaining the social world (Saunders *et al.*, 2009), which requires the researcher to become a full member of the group being studied, in order to understand the phenomenon being investigated (Collis and Hussey, 2009; Easterby-Smith *et al.*, 2008). In the current research, the researcher is outside the natural setting and seeks to develop a framework to empower local governments to make disaster resilient cities. Therefore ethnography would not be applicable in this context. Alternatively, grounded theory which is helpful for researchers to predict and explain behaviour to build theory (Saunders *et al.*, 2009) and case studies, which involve an empirical investigation of a particular phenomenon within its real life context using multiple sources of evidence (Yin, 2009) can be identified as the most suitable strategies for this research.

Between grounded theory and case studies, case studies has been selected as the most appropriate strategy for this context as it enables the researcher to obtain a good understanding of the context of the research and the processes (Saunders *et al.*, 2007), and it would be possible to get the answers to both the explanatory and the design part of the research. A case study is an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2009). One important strength of the case studies is the ability to undertake an investigation into a phenomenon in its context and therefore case studies are considered as a valuable way of looking at the world around us (Rowley, 2002).

In addition, according to Yin (2009), three aspects need to be considered in selecting an appropriate strategy, namely; the type of research questions posed, the extent of control the investigator has on the actual behavioural events and the degree of focus on the contemporary as opposed to historical events. 'How' and 'why' form of research questions usually require detailed investigation and case studies are one strategy that supports detailed investigation which is necessary to answer these type of questions. In the current research the study is mainly focused on answering 'what' and 'how' forms of research questions. For example this research seeks to answer questions like, "how could local governments be empowered to take a leading role in making cities resilient within the context of the built

environment?”, “what are the weaknesses of the existing local governance structure in relation to making disaster resilient cities?” which require a detailed investigation and in such instances, the researcher does not have control over the behavioural events and needs to conduct the study in the real-life setting. The study also focuses on a contemporary event where existing background knowledge is present to develop an initial conceptual framework which justifies the selection of the case study research strategy. On the other hand, case studies have a unique strength to deal with a full variety of evidence-documents, artifacts, interviews and observations, and this had an impact on the selection (Yin, 2009). As such adopting case study strategy allowed the use of multiple sources of data collection and analysis, which has increased the credibility of research findings.

Case study design

According to Creswell (2003), case study research involves the study of an issue explored through one or more cases within a bounded system. Case studies are more appropriate in the circumstances where the research seeks to answer ‘how’ and ‘why’ research questions (Yin, 2009). This research mainly focuses on answering a ‘how’ type of research question which is “how the local government can be empowered to make the cities resilient to disasters” and therefore would be more appropriate for a case study approach. The nature of this research requires gaining a rich understanding of the context of the research and the processes being enacted (Saunders et al., 2009), and therefore, the case study strategy would be the ultimate strategy for this research. Case studies may offer insights that might not be achieved with other strategies (Rowley, 2002) and thus case studies have been selected as the most suitable strategy. Yin (2009), has distinguished between four case study strategies based upon two dimensions such as, single case vs. multiple case and holistic case vs. embedded case. According to Saunders *et al.* (2009), single case is used where it represents a crucial case or alternatively an extreme or unique case. As far as this research is concerned, different cities have different administrative structures and are resilient to disasters in varying degrees. Thus, as argued by Yin (2009), this research has used a multiple case design since there has been no strong justification for the choice of a single case study, and as it is preferred over single case design. In looking at the second dimension of Yin’s (2009) argument regarding holistic case vs. embedded case, he refers to the unit of analysis. As defined by Miles and Huberman (1994), the unit of analysis of a study is a “phenomenon of some sort occurring in a bounded context”. In this research, a city is taken as a case and the research is concerned with the empowerment of local government and their contribution towards making cities resilient. Therefore the unit of analysis for this research can be taken as ‘the empowerment of the local government’. As such this research takes a holistic case type. Accordingly, it is intended to conduct three holistic case studies by selecting three cities in Sri Lanka which are potentially vulnerable to disasters and the findings would be generalised across the country. Further, the case boundary could be defined as the city in which the research is being conducted.

Validity and reliability in case study research

How the quality of the research is maintained and managed is a key requisite in qualitative research. According to Yin (2009) four tests are commonly used to measure the quality of case studies being conducted. These include; construct

validity, internal validity, external validity and reliability. Table 1 highlights the different tactics that are intended to use in this research to fulfill the requirements of these four tests. These tactics will ensure the validity and reliability of the case studies being conducted.

Table 1: Case study tactics for four design tests (adapted from Yin, 2009)

Test	Case study tactic used in the research	Phase of research in which tactic occurs
Construct validity	Use of multiple sources of evidence Getting draft case study report reviewed by key informants	Data collection Composition
External validity	Pattern-matching Explanation building Address rival explanations	Data analysis Data analysis Data analysis
Internal validity	Use of replication logic	Research design
Reliability	Use case study protocol Develop case study database	Data collection Data collection

Research choices

According to Saunders *et al.* (2007) in choosing the research methods the researcher can either use a single data collection technique and corresponding analysis procedures (Mono method) or use more than one data collection technique and analysis procedure to answer the research questions (Multi method). He further argued that if the researcher chooses to combine data collection techniques and procedures using multiple methods design, four different possibilities are available, namely, multi- method quantitative studies; multi- method qualitative studies; mixed method research and mixed model research.

As explained elsewhere the research concerned is aimed at gathering qualitative data and comes under the broader context of qualitative research. Qualitative researchers typically gather multiple forms of data by way of interviews, observations and documents, rather than relying on single data source (Creswell, 2007). Accordingly this research is a multi-method qualitative study which intends to use a combination of more than one data collection technique with associated data analysis techniques, more details of which will be discussed under the section ‘techniques and procedures’. This will strengthen the validity of the research as the researcher will review and analyse all the data that cut across different data sources (Creswell, 2007).

Time horizon

Time horizon is an important element in planning any research project. There are two perspectives for time horizon, namely, cross sectional studies and longitudinal studies (Saunders *et al.*, 2007). Within the cross sectional studies the researcher investigates particular phenomenon at a particular time and the research will be a ‘snapshot’ taken at a particular time (Saunders *et al.*, 2007). In contrast, the

longitudinal studies focus on investigating variables or group of subjects over a long period of time (Collis and Hussey, 2009).

Considering the nature of the research concerned, it is clear that it does not require an investigation over a long period of time. The aim of the current research is to develop a framework to empower local governments to make disaster resilient cities. Accordingly, the investigation is intended to carry out at a given point of time and therefore falls within a cross sectional study.

Techniques and procedures

Sri Lanka, being one of the countries which was badly affected by the 2004 Tsunami and also by floods on various occasions, has been selected for this research as the country is in great need of disaster resilient cities. As such, in this research it is proposed to conduct three case studies within Sri Lanka by selecting three geographical areas within the country. The cities have been selected based on the judgement of the researcher which allowed selecting those cities which were particularly informative in nature. As such the cities which have been badly affected by disasters and which are prone to future disasters were chosen.

In case study research, a bounded system or multiple bounded systems can be explored through detailed and in depth data collection involving multiple sources of information such as observations, interviews, audio visual material and documents and reports (Creswell, 2003). Within the case studies, interviews have been conducted to gather valid and reliable data that are relevant to the area of study. The interviews were designed to capture the city's resilience to disasters and to understand the commitment of the local government in making the city resilient to disasters and associated problems. As such, the data were gathered through semi-structured interviews with the local and other government officials, policy makers, industry practitioners and experts who are engaged in the respective areas of study.

In addition, two series of expert interviews are conducted with the experts in the field of study. The first series of expert interviews has already been conducted with the view of gaining background knowledge pertaining to this field of study. The second series of expert interviews will be conducted in the latter part of the research for the framework validation purposes. The main idea behind conducting expert interviews is to reduce the biasness in data sources and to increase the validity and the reliability of the research conclusions by way of triangulating multiple sources of data and multiple methods of data collection.

In the meantime, government and other publications relating to the establishment of local governments, their structure and other administrative and funding arrangements, have been studied to get an in depth idea about the cases to be observed.

Finally, the data collected would be analysed based on the explanation of analysing qualitative data as indicated by Saunders' *et al.* (2009), which involves summarising the data, categorising and structuring the data using narrative to recognise relationships, develop and test propositions and produce well grounded conclusions. NVivo (version 9) software will be used at the data analysis stage to manage, organise and analyse qualitative data. This software has many features that help the process of qualitative analysis, which is effective when dealing with a large number of interview transcripts.

As multiple cases are chosen, when interpreting data, first a detailed description of each case and themes within the case would be analysed, followed by a thematic analysis across the cases (Creswell, 2003). The data analysis and data collection would be conducted simultaneously which would help in refining and validating the framework throughout the data collection and analysis phase.

Conclusions

A research is a systemised effort to search for new knowledge. The paper presents the research methodology of a doctoral research aimed at developing a framework to empower local governments to make cities resilient to disasters. In doing so, the paper has presented and justified the research methodology from the establishment of the research problem to data collection and analysis. The study applies interpretivism as its philosophy and theoretical underpinning. The main focus of this research is to develop a framework to empower local governments to make cities resilient to disasters which is a complex issue and the paper argued that this cannot be theorised by definite laws as physical sciences. Case studies have been selected as the preferred research strategy and the rationale for selecting the case study strategy has been presented. The study intends a holistic multiple case design in which the unit of analysis becomes “the empowerment of the local government”. Accordingly, three case studies have been conducted by selecting three cities in Sri Lanka which are potentially vulnerable to disasters. Within the case studies, semi-structured interviews have been conducted together with document reviews. In addition, two series of expert interviews would be conducted with the experts in the field of study to reduce the biasness in data sources and to increase the validity and the reliability of the research conclusions. The research is still in progress, and the measures taken to ensure the acceptability of the research findings are also discussed.

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A Soft System Value Management (SSVM) Approach to Delivering Stakeholder Satisfaction in Sustainable School Projects in Ireland

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Abstract

The central statistics office in Ireland indicates that the first quarter of 2011 was the highest quarterly birth rate since central statistics began in 1949. These national population projections signify that the number of enrolments in primary schools will continue to rise in the coming years and it is therefore timely to consider the nature and quality of these schools and how they are to be built. In relation to this paper a case study has been carried out on generic repeated design school where the design is set by the Department of Education and Skills. The Department sees this generic prototype as the benchmark for primary school accommodation for at least the next decade and they also see these schools as demonstrating the government's commitment to a sustainable future so it is crucial to investigate these schools. This work identifies and prioritises the various factors that contribute to stakeholder satisfaction at the construction stage of one of these sustainable school projects.

Keywords

Ireland, Schools, Stakeholder Satisfaction, Sustainability, Value for Money.

1. Introduction

The aim of this paper is to identify and prioritise the various factors that contribute to stakeholder satisfaction at the construction stage of a sustainable school project. In examining the problem the areas that are emerging is that identifying all stakeholders, assessing behaviours and attributes, investigating relationships and communication are important. In relation to the sustainability side the environmental issues are important but so too are the people involved in the school and the community that the school is built in.

A generic repeat design (GRD) school project consists of a design for a standard 8, 12, and 16 classroom school undertaken by the Department of Education and Skills in Ireland (DoE). The aim of this is to produce a building design that uses less than 50% of the energy used by a school built to good practice standards without significant additional cost. As Sheppard (2008, p.776) stated 'the overall energy impact of the design is considerable as 50 plus schools will be constructed to this proven and optimised, low energy design.' The generic prototype will be looked upon as the Department's benchmark for primary school accommodation for at least the next decade. What is even more interesting is that the Department of Education and Skills see these schools as having a wider educational role in environmental

awareness and will demonstrate the government's commitment to the sustainability agenda. A case study research project on one of these GRD schools projects, which was completed in June 2012, has been undertaken to explore these issues. The research objectives can be defined as follows:

- Formulate and develop an understanding of value for money and stakeholder satisfaction in the context of sustainable school construction projects.
- Identify project stakeholders and their influence on project outcomes.
- Explore the role that sustainability has to play in relation to the construction stage of sustainable school projects.
- Produce an understanding of the factors that influence stakeholder satisfaction and the sustainability of school projects.

2. Literature Review

2.1 Value for money

The challenge with value engineering (VE), value management (VM) and risk management (RM) is that they look at distinct phases in the construction process. In general VE looks at the concept phase, VM looks at the design phase and RM looks at the construction phase. If value for money is truly required in relation to a construction project then the project needs to be looked at completely from inception to completion. A survey undertaken in 2004 (Fong 2004) indicates that most practitioners have used VM in the last 6-10 years, and that the main reason for using VM is only for cost reduction. It is clear from this that the use of VE and VM may be declining as it is not achieving its goal of achieving true value for money. The reason for this might be that it is not looking at a construction project as a whole from inception to completion. One of the ways of moving value management forward was proposed by Leung *et al.* (2003). The major characteristics of the soft value management system, which was established by Leung, include various behavioural factors such as participation, communication, interaction, conflict resolution and feedback. From an Irish perspective on GRD projects the DoE believe that VE has been achieved by using cost limits for the design and construction of schools, VM is achieved due to the fact that it is a repeat tested design and risk management is achieved by use of the Government Construction Contracts Committee (GCCC) form of construction contract (Department of Finance 2007) which transfers the majority of risk to the contractor. It is clear from this that the DoE are achieving value for money by looking at the 'hard' side but in order for true value for money to be achieved on GRD schools then the 'soft' problems of stakeholder satisfaction and sustainability also need to be addressed.

2.2 Stakeholder satisfaction

A review of the literature suggested that there are numerous critical success factors (CSF) that can be implemented in relation to achieving stakeholder satisfaction on a construction project. Critical success factors as defined by Saqid *et al.* 2008 are that certain factors are more critical to project success than others. Many of the scholars studying stakeholder management (Olander, 2006; Walker *et al.*, 2008; Jepsen and Eskerod, 2008) have pointed out the significant importance of identifying stakeholders. Olander and Landin (2008) note competing value systems, diversity, internal complexity and changing relative importance of the clients' constituent stakeholders each of whom has a different value. So the first critical success factor in relation to stakeholder satisfaction on a GRD school project is the identification

of stakeholders. If this is achieved then it is one facet of achieving a successful construction project. The next CSF is assessing stakeholders' behaviour in relation to the project. Stakeholders' behaviour can be sorted into three categories: observed behaviour, cooperative potential and competitive threat (Freeman *et al.* 2007). By analysing and estimating these three attributes a project manager enhances the understanding of all stakeholders and is thereby better informed about how to manage relations with them. The relationships between the project and its stakeholders are also a vital ingredient in the successful delivery of projects and meeting stakeholder expectations (Jergeas *et al.* 2000). So what needs to be addressed is how the relationships of stakeholders are managed in relation to GRD school building projects and if anything can be done to improve this relationship during the construction stages of a GRD school project.

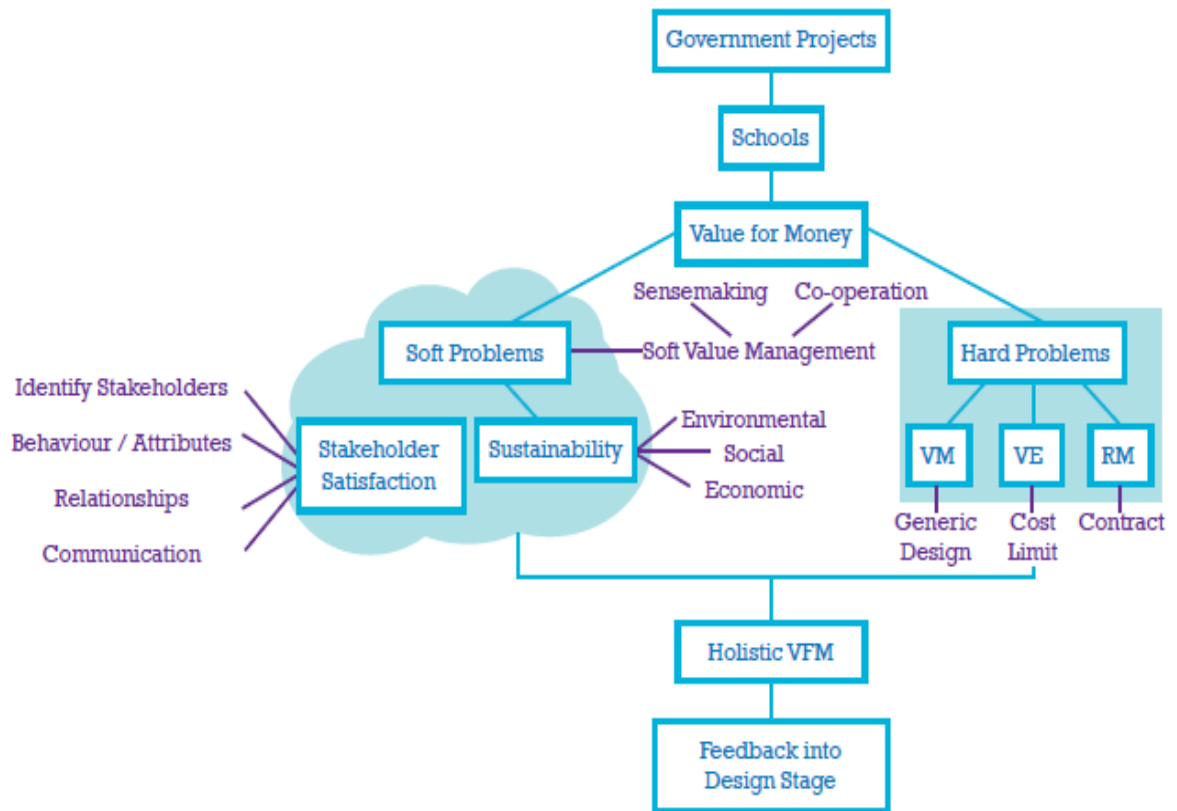
Communication is also essential for maintaining the support and commitment of all stakeholders. It is important that communication is timely, accurate and relevant which is important for project success (Karlsen *et al.* 2008). In addition, Weaver (2007) believes project managers should be highly skilled negotiators and communicators capable of managing individual stakeholder's expectations and creating a positive culture within the overall organisation. Young (2010) considers that the key to good stakeholder management is management of the relationship between the project team and its stakeholders. All this leads to the conclusion that the ability of the project manager to communicate with all stakeholders is critical to the success of the project and ultimately a schools project that achieves value for money. As can be seen from Figure 1 there are a number of CSF that need further investigation in relation to stakeholder satisfaction on GRD school projects.

2.3 Sustainability

The definition of sustainability and sustainable development is evolving over time and commonly the terms are interchangeable to broadly describe an approach that addresses the environmental, economic and social challenges mankind faces (Murray and Cotgrave, 2007). Turner (2006) has noted that the aspiration to integrate environmental concerns into all aspects of social and economic life brings unexpected cultural, social and political challenges. This was reinforced by Murray and Cotgrave (2007) when they advocated that social and economic influences are harder to quantify and document than the environmental impact. In relation to a GRD school projects the environmental considerations seem to be addressed in these schools as the design is generic. What appears to be much harder to quantify is the social and economic aspect. These areas also need to be further investigated in relation to the case study.

2.4 Summary of Emerging Issues

As set out in Figure 1 there are a number of areas that need further investigation following the literature review. These areas include identifying stakeholders, behaviour and attributes, relationships and communication. In relation to sustainability it is well defined in the literature that not only the environmental impact of this school need addressing but also the social and economic aspect of the school.



3. Research Design

The case study research method was utilised which involves the collection of evidence in the form of documentation, archival records, interviews, direct observation and physical artefacts (Biggam 2008). Multiple sources of evidence were obtained including content analysis of information on the building of a GRD school in Ireland. This included gaining an understanding of the GRD design, the stakeholders involved, the procedure involved in getting this project to construction stage and the facilities in the adjoining area. As can be seen from Figure 2 seven semi-structured interviews were carried out. The Department of Education and Skills was interviewed in relation to GRD design as they were instrumental in the introduction of this design. They also had information in relation to other projects undertaken using the GRD design philosophy and whether the problems that were occurring in relation to the construction of the case study GRD school were being repeated in other schools. The school principal was also interviewed in order to obtain background information in relation to the construction of the school. It was also beneficial to interview the school principal in relation to his future aspirations to develop a sustainable community in the area. The architect was interviewed as the client's representative on site and the person who has been involved in the design of this project for over 10 years. The quantity surveyor interview consisted of gaining their opinion in relation to how this GRD project on site has progressed. The structural engineer was also interviewed as they not only had to work with this generic repeated design but also had to design the substructure and ancillary site works to suit the design. The service engineer has also been involved with this

project for over 10 years and had information in relation to the environmental sustainability of this generic repeated design. Finally the main contractor was interviewed to gauge whether construction onsite of the design is achievable and how it differs from the construction of a standard design of a school.

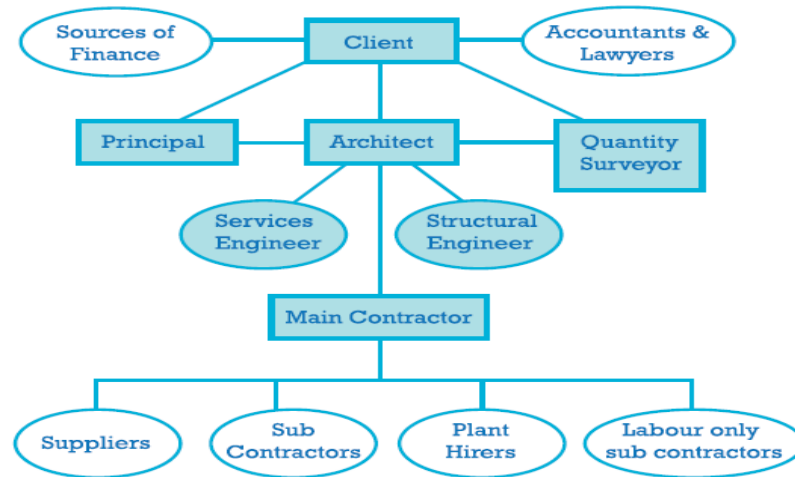


Figure 2 Stakeholders of GRD school project

3.2 Data Analysis

In order to analyse the information obtained thematic analysis was employed. This involves ‘identifying, analysing and reporting patterns (themes) within the data’ (Braun and Clarke, 2006). The information obtained during the interviews were categorised using the themes that emerged during the literature review stage. Through doing this relationships began to be recognised and developed. These emerging themes were then compared with the findings from the literature review to see what themes need to be addressed and carried further.

4. Findings

As can be seen from Figure 3 there are a number of areas that have emerged following the case study. In relation to stakeholder satisfaction and identifying stakeholders the school principal is an important stakeholder in relation to getting the project to construction stage. If the school principal is not willing to champion the project then the project will not get past approval stage and onto construction stage. The two stakeholders that can have a detrimental effect on the success of a GRD school project are the fire officer and the disability access officer. Not only can they not issue a certificate thus preventing the school from being able to open but they can also insist on changes been made to the generic repeated designs. In relation to the theme behaviour and attributes what has emerged is that all consultants are spending an enormous amount of time on these projects, more than they have included in their fees. It appears there is a willingness to get this project complete at all costs with consultants indicating that they were dedicating time to this project in order to gain repeat work in the future. Another area that has emerged under the theme of behaviour and attributes is the fact that even though a generic repeat design was used for this project drawings still had to be altered as some information was missing from the drawings. This should not be occurring in relation to this generic repeat design and it appears that a loop has not been closed. This area

overflows into the next theme which is the mechanism to approve alterations. As all changes have to go through the employer's representative (the architect) on this project, this takes time. Also within the DoE there are individuals with responsibility for different changes so there is no single point of responsibility in the clients' organisation. Under the theme relationships there appears to be conflicting reasons as to why there is a good relationship between the consultants and the contractor. All consultants are of the opinion that the good working relationship is down to the fact that this project does not have a "them versus us" attitude and that some of the consultants have worked together on this project for 10 years. The contractor also indicated that the philosophy that their company is not claims conscious is one of the reasons for the good working relationship. The DoE is of the opinion that the good working relationship is due to the fact that conflict does not exist between the consultants and the contractor as the design is tried and tested. A good working relationship exists in relation to the construction of a GRD school which needs to be encouraged and supported as it means that stakeholders are satisfied and feel that the project is a success. In relation to communication all stakeholders in the supply side acknowledge that communication between them is effective but between them and DoE it is not satisfactory. This is an area that keeps emerging and it is an area that needs addressing in the future. The DoE are of the view that as this is a GRD design the involvement of the DoE should be minimal. The consultants on the other hand feel that if this is the case then more autonomy should be given to the employer's representative on-site to make decisions without having to gain the approval of the DoE at all times. Under the field of sustainability a number of areas have come to the fore. The environmental aspect is still important but only tried and tested technologies are used. In relation to the social and economic aspect of sustainability a number of interesting issues have emerged. The inclusion of the staff and pupils in the construction stage of this project has encouraged the social inclusion of the community in the new school. The location of the new school is also an important consideration. As the new school is located adjacent to existing community facilities this adds to the inclusion of the new school in the local community. Finally the drive by the school principal to open up this school after school hours to the local community also adds to the social and economic sustainability of the project.

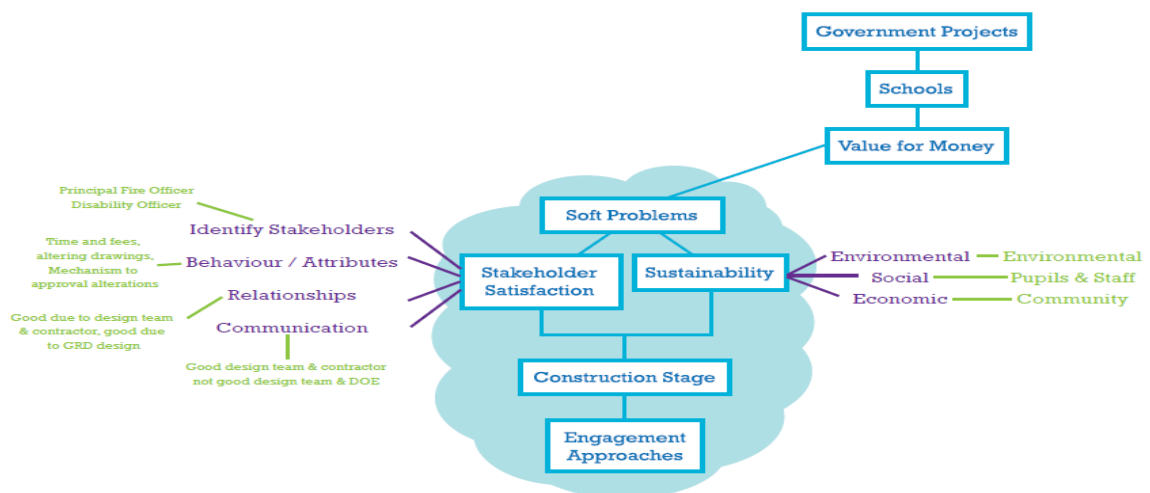


Figure 3 Emerging Issues following empirical research

5. Conclusion and Further Research

5.1 Conclusion

The overall aim of this research was to identify and prioritise the various factors that contribute to stakeholder satisfaction at the construction stage of a sustainable school project. What has been established is that utilising value management, value engineering and risk management in order to achieve value for money on a school construction project is only looking at one aspect of value for money. By utilising soft value management a more balanced picture can be achieved. The literature review has shown the softer aspect of stakeholder satisfaction also needs to be addressed if true value for money is to be achieved. There were a number of critical success factors that can be implemented in order to achieve stakeholder satisfaction however, not all of these factors can be applied to a GRD school building project. The areas that can be included in a GRD project include identifying stakeholders, the behaviour and attributes of those stakeholders, relationships between stakeholders and effective communication.

In relation to identifying stakeholders and their influence on project outcomes this has been addressed through the literature and followed up in the interviews. One of the stakeholders with a considerable influence on the outcome of the project is the school principal. The principal needs to be the type of individual that can drive a project in order for the project to be a success. Stakeholders that have been found following interviews to have a very large influence on the success of project are the fire officer and the disability access officer. Not only can they refuse to issue certificates required to commence work on site but they can also require changes to be made to the designs on site adding to the overall cost and pushing back the programme on site. The DoE itself also has a role to play in relation to stakeholder satisfaction. It has been found that communication between the supply stakeholders and the DoE is an issue which needs addressing if true value for money is to be achieved.

Exploring the sustainability of a GRD school project has found that sustainability does not just have an environmental aspect it also has a social and economic aspect that needs addressing if true value for money is to be achieved. It has been found in relation to the environmental aspect of sustainability tried and tested technologies are implemented into the design of GRD school projects. In relation to the social and economic aspect of a sustainable project again it was established that the principal of the school has a vital role to play in relation to engaging with the community and engaging with pupils and staff. By getting the pupils and staff involved in understanding the construction stage of the project this in turn engages the community in the project. Another interesting result is that local authority where a school is being built can also have an important role to play in the construction of a truly sustainable school projects in a community. This is achieved by the local authority providing funding for additional facilities and community services adjacent to a new GRD school.

A number of factors that influence stakeholder satisfaction and the sustainability of school projects have been recognised from this research. These include a design that needs approval from all local authority fire officers and disability access officers prior to commencement of work on site. Any issues in relation to the GRD design itself needs to be addressed so that on future projects the same issues are not coming

up again and again. The DoE needs to have a person in the organisation assigned to each individual project in order for communication and relationships to work. In relation to sustainability the link between the local authority the DoE and the school principal needs to be stronger in order to ensure that a truly sustainable project is achieved in the community.

5.2 Further Research

Through achieving the research objectives as demonstrated above the following recommendations can now be made in relation to further research. These include:

- A further study needs to be carried out on other GRD school projects to see if the results from this research can be transferred to all GRD school building.
- An analysis of any procedures that are in place in local authorities to decide whether to influence the sustainability or otherwise of a school building project needs to be undertaken.
- It is recommended that a post-occupancy review is carried out on every school once construction is complete in order to determine whether the initial aspirations have been achieved.
- The loop in relation to errors that are appearing on the GRD drawings needs to be closed off so that problems on other projects do not occur in the future.

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Partnering in the Construction Industry – A Critical Analysis of Research Trends

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Abstract

Huge efforts have been made in order to stimulate thorough improvements in the construction industry in terms of value for money, feasibility and consistency when facilitating a partnering approach. Despite this attention there is limited documentation on the development of research trends, thus gaps in existing body of knowledge. The objective of this literature-based paper is to explore the current literature by systematically reviewing and summarizing research trends in leading top-tier construction management journals between 2002 and 2012, addressing how the themes in partnering related publications change across this period. It is concluded that trends such as research on developing trust among construction partners to facilitate project success, feasibility of and the barriers to adopting a partnering approach and strategic propositions for overcoming barriers are highly emerging. Finally, it is suggested to monitor research trends to obtain insights into partnering issues whereby relevant contribution to research gaps can be made.

Keywords

Construction partnering, Journal ranking, Reviews, Research themes, Research trend.

Introduction

A systematic review of past research trends and literature is essential for any academic research (Webster and Watson, 2002). Prior to initiating any research study the need to uncover what is already known in the body of knowledge should not be underestimated. Since its beginning in the early 1980s partnering in construction has been overexposed from theoretical exploration to practical application (Cook and Hancher, 1990), lacking an overview of the current status and partnering research clarifying a gap for future trends of research. In a follow-up on partnering research trends up until 2009 Hong et al. (2012) state that because of the diversification in research topics under the partnering models with unsatisfactory analysis of partnering related issues, there is a need to explore, analyze, and summarize the research trend of partnering related studies in construction to fill the aforementioned gap. One can argue that there is a gap where integration and classification of literature within the domain of partnering may prepare the ground for impending researchers to obtain a more clear understanding of the topic, thus conduct supplementary research more effectively and efficiently. To gain comprehensive overview and insight into research trends within the area of

partnering in construction projects retrieval from academic journals can be regarded as the most effective approach (Hong et al., 2012, Bygballe et al., 2010). Tsai and Wen (2005) argue that being aware of some important academic journals helps to understand the field of science more widely, thus having a methodical analysis of articles published in top tier academic journals may well assist researchers to explore the current status and future trends of one specific topic. However, only a few of such critical analyses have been undertaken in the field of partnering to date only covering up until 2009 (Black et al., 2000, Hong et al., 2012, Tang et al., 2006). This paper is therefore an attempt to systematically review partnering related literature, only concerning the construction industry, and to uncover research trends of partnering related articles in leading top tier journals on construction management between 2002 and 2012, inclusive, thus addressing the following questions:

1. What was the coverage of partnering related studies published in construction journals across the period?
2. How did authors contribute to partnering related studies and applications?
3. How did the research topics published in the journals vary across the period?

This paper expands on the current literature on the subject by systematically reviewing the past research trends and literature, thus providing a critical overview of the development of construction partnering in the academic field and, hence, establishing a solid reference platform for further research to obtain more useful insights into partnering issues whereby relevant research gaps are clear.

Construction partnering over time

In the late 1980s partnering emerged as a new project collaboration method which seeks to create a win/win assertiveness among all construction parties in ideal situations (Smyth, 1999, Lazar, 2000). In order for this to work partnering must create a trust-based environment, thus encouraging participants on a project to make maximum contributions to achieving the completion of a successful project thus creating a win/win situation for all (Cowan, 1992, Scott, 2001, Construction Industry Institute, 1991, Millard, 1992, Zhang et al., 2006). Since the 1980s partnering has been applied increasingly in the construction industry, especially during the past fifteen years. Recently, further advancement to partnering termed "partnering-light" has also been successfully utilized in the construction industry. Besides including key factors contained in partnering, partnering-light uses a clearly defined risk allocation with gain share/pain share to manage the process. In this light model of partnering, parties contractually commit to their contribution levels and required profit and then place these at risk in undertaking the project. This provides a powerful incentive to achieve project goals. Even though partnering to some degree has shown to increase quality and value (Tang et al., 2006, Larson, 1995, Davis and Love, 2011, Eriksson et al., 2007), competitive tendering seems to be coming back with a vengeance. In the future, would we think that "partnering" was just a candy-trendy-word in the industry, flavored with a salad dressing named "collaborative working", or is there still something overlooked in the message of economic gain, temporal reduction and increased value as Bennett & Jayes state back in 1995 in their book *Seven Pillars of Partnering*. This study will therefore focus on identifying coverage of partnering related studies published in construction

journals during the period between 2002 and 2012, thus how the themes of the partnering related publications change or evolve during the period.

Methodology

Despite the large number of studies in the area of partnering conducted since the early 1980s, little attempt has been made to translate these findings systematically into a comprehensive review of current knowledge, thus compiling an overview of the current body of knowledge. Furthermore, there have been only a few attempts like Hong et al. (2012) to link such knowledge to a present gap in the existing BoK, where it could be purpose wise and relevant to conduct new research, as one of the main definitional components of research is the ability to add to the current BoK (Pittaway et al., 2005).

This paper is based widely on the review methods used by Pittaway et al. (2005), Tsai and Wen (2005), Hong et al. (2012), Levy and Ellis (2006) to illustrate research output published in the top tier journals in the chosen topic, partnering. Under the assumption that authors first and foremost publish their research in relevant journals with the most publications in the field or in journals with similar subjects, a close eye has been kept on the journals with the highest number of publications since it has not been possible to obtain an actual list of highest-rated journals the only way to build such a database is to keep track on the findings. To enable a transparent and thorough investigation of partnering trends, the study adopted an 3-stage literature review method to find all partnering related papers published between 2002 and 2012, inclusive. The review strategy has a number of stages designed to provide a systematic and explicit method for the review as outlined in the Introduction.

In stage 1 keywords on the subject based on prior experience were identified. The keywords were identified using a form of brainstorming. They included, for example, partnering, relationship, alliances, strategic, cooperation, project, construction, among others. Papers with these specific terms included in the title, abstract or keyword were considered to have met the needed requirements of this study. The keywords were then constructed into search strings. An initial comprehensive search was conducted under the title/abstract/ keyword field of the powerful search engine Web of knowledge using the basic search string:

TITLE-ABS-KEY ("Partnering" AND "Construction") DOCTYPE (ar) AND PUBYEAR AFT 2002 AND PUBYEAR BEF 2013 AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j"))

Search result: 3,585(searched on 5 January 2013).

The results were indexed in EndNote and used to identify further keywords for the main search. For example, additional words, such as relationship, partner, co-operation, collaboration and alliance were found to be important during this secondary analysis.

In stage 2 a new search string was used in six search engines to identify four key citation indexes for the review. These were chosen based on the volume of citations relevant to the basic search string. The search engines reviewed include ABI Proquest, Business Source Premier, Science Direct, Web of Knowledge, EBSCO and Emerald. The full search code is as follows:

TITLE-ABS-KEY ("Partnering" OR "Project Partnering" OR "Strategic Partnering") AND TITLE-ABS-KEY ("Construction" OR "Building" OR "Relationship" OR "Co-operation" OR "Collaboration" OR "Alliance") DOCTYPE (ar) AND SUBJAREA (ener OR engi OR busi OR deci OR econ OR soci OR manag) AND PUBYEAR AFT 2002 AND PUBYEAR BEF 2013 AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j"))

Search result: 612 (searched on 7 January 2013)

The search was further limited to subject areas such as engineering, business, management, decision sciences, econometrics and finance, economics, and social sciences with the document type of journal. An important note here is that the search was strictly limited to the area of partnering within construction/building, thus excluding all other unrelated publications with non-relevance to partnering. Still some unwanted publications may still exist in the search results because of the broad wording of keywords used in search. To overcome this issue and to narrow down the outcome it was chosen only to analyze the search results in terms of well-known top ranked journals, based on the number of partnering articles published per year. The construction related journals that have published the most partnering papers were therefore selected for further analysis. The search result derived from stage 1 indicated that the International Journal of Project Management (IJPM), Engineering, Construction and Architectural Management (ECAM), Construction Management and Economics (CME), Construction Innovation (CI), Automation in Construction (AIC), Journal of Construction Engineering and Management-Asce (JCEM) and Supply Chain Management: An International Journal (SCMAI) have published the most partnering related articles amongst construction management related journals. Note that these journals are also among the top twenty journals in the ranking list derived from the academic research engine brought by Microsoft, see Table 1, which further emphasizes the validity of the search. Four additional journals within ranking list are the Building and Environment (BE), Journal of Facilities Management (JFM), Journal of Management in Engineering (JME) and Journal of Purchasing and Supply Management (JPSM). These journals are not directly related to the research area but the decision to inclusion of these journals is based on the published articles and that they are widely reviewed in the area of construction engineering and management, and each published a certain number of partnering related papers on construction partnering. Furthermore, several articles with considerable value for reference were published in these four journals. To summarize, the target journal list includes these eleven top ranked construction related journals: IJPM, ECAM, CME, CI, AIC, JCEM, SCMAI, BE, JFM, JME and JPSM.

To elaborate the method of selecting the target journals for the final search of articles for the comprehensive review of partnering studies in the third stage, the criteria for journal selection are summarized as follows:

1. Construction related journals with a considerable number of publications and H-index on partnering related studies according to the search result in the first stage.
2. Construction journals ranked within the top 20 in the ranking list derived from academic research engine brought by Microsoft.
3. Construction journals accredited as top ranked and most valuable for peer review by the research community.

Criterion 1 was set up on the basis of the search result of the Web of knowledge search engine. Among all journals publishing partnering related papers shown in this search engine, only the top ranked included in the search result, whereas CME, ECAM, JFM, CI and BE were included in the target journal list according to criteria 2 and 3. Criterion 3 was selected as a control, so that journals with high impact factors according to the most recent ISI Journal Citation Report were selected for further analysis. Exclusion of other construction related journals from analysis is primarily because they are either not among the top ranked journals with relatively high impact factors or they have published very few, if any, papers related to partnering studies. To ensure that the journal selection criteria are as objective as possible, concerted efforts were made in this study.

Table 1: Construction related Journal Ranking List (Derived from Microsoft Academic Search Engine and ISI Journal Citation Report®)

No. :	Journals	Publications (2002-2012)	Citation (2002-2012)	H-Index (2002-2012)	5-Year Impact Factor (From ISI)
1	International Journal of Project Management	774	7310	37	na
2	Supply Chain Management - An International Journal	562	4182	30	na
3	Automation in Construction	983	4442	25	1.702
4	Journal of Purchasing and Supply Management	261	2164	24	na
5	Journal of Construction Engineering and Management-asce	1074	5383	23	1.102
6	Construction and Building Materials	2226	6500	22	2.134
7	Construction Management and Economics	977	3941	22	na
8	Building Research and Information	577	2684	22	1.372
9	Journal of Constructional Steel Research	1225	3470	18	1.285
10	Journal of Management in Engineering	226	956	15	0.943
11	Engineering, Construction and Architectural Management	345	1076	14	na
12	Journal of Bridge Engineering	673	1458	12	0.784
13	Journal of Facilities Management	209	560	11	na
14	Construction Innovation: Information, Process, Management	299	678	10	na
15	Built Environment	274	649	10	2.281
16	Journal of Performance of Constructed Facilities	462	619	10	0.634
17	Building Services Engineering Research & Technology	256	535	9	0.771
18	Architectural Science Review	396	332	7	na
19	Structural Survey	223	284	7	na
20	Baltic Journal of Road and Bridge Engineering	66	206	7	1.217

In stage 3 a more attentive search of selected target journals was carried out using the same search engines, ABI Proquest, Science Direct, Web of Knowledge and Emerald. The full search code are as follows:

TITLE-ABS-KEY ("Partnering" OR "Proje\$t Partnering" OR "Strategic Partnering") AND TITLE-ABS-KEY ("Construction" OR "Building" OR "Relationship" OR "Co-operation" OR "Collaboration" OR "Alliance") DOCTYPE (ar) AND SUBJAREA (ener OR engi OR busi OR deci OR econ OR soci OR manag) AND PUBYEAR AFT 2002 AND PUBYEAR BEF 2013 AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (EXACTSRCTITLE, "International Journal")) OR LIMIT-TO (EXACTSRCTITLE, "Supply Chain Management") OR LIMIT-TO (EXACTSRCTITLE, "Automation in Construction") OR LIMIT-TO

(EXACTSRCTITLE, "Journal of Purchasing and Supply Management") OR LIMIT-TO (EXACTSRCTITLE, "Journal of Construction Engineering and Management") OR LIMIT-TO (EXACTSRCTITLE, "Construction Management and Economics") OR LIMIT-TO (EXACTSRCTITLE, "Journal of Management in Engineering") OR LIMIT-TO (EXACTSRCTITLE, "Engineering, Construction and Architectural Management") OR LIMIT-TO (EXACTSRCTITLE, "Journal of Facilities Management") OR LIMIT-TO (EXACTSRCTITLE, "Construction Innovation") OR LIMIT-TO (EXACTSRCTITLE, "Built Environment"))

Search result: 282 (searched on 9 January 2012)

The now more detailed search in the four selected databases gave a total of 282 results evenly distributed in the following manner ABI Proquest (96), Science Direct (78), Web of Knowledge (44) and Emerald (64). It was obvious that not all journals were covered equally in the four databases, which meant that many duplicates appeared, a total of 61 articles were downloaded more than once in the search, when a more detailed review in EndNote was conducted the number of duplicated articles were as follows ABI Proquest (50), Science Direct (28), Web of Knowledge (20) and Emerald (32) which meant that the total number of articles was reduced to 221. After the three-stage search, a total of 221 partnering related papers were identified as being published in the selected eleven construction journals. A total of 61 papers shown in the search result for the four selected databases were excluded from further analysis given their status as duplicates. By a further analysis another 79 articles were excluded given their irrelevance to partnering studies after a critical and consistent evaluation, so the total of partnering related papers came down to 141. The new distribution was as follows ABI Proquest (66), Science Direct (22), Web of Knowledge (30) and Emerald (23). An important note to be made here is that covering a complete set of partnering related articles on the basis of individual discernments and judgment for identifying partnering related papers is difficult, if not impossible, this paper primarily looks for a trend in construction partnering research within the area of engineering and management through a critical review.

Discussion

Annual contributions from construction journal of partnering related papers

In the second stage search result on the basis of the search engines ABI Proquest, Science Direct, Web of Knowledge and Emerald, the total number of construction partnering related papers identified was 612, with a perennial increasing trend from 30 in 2002 to 67 in 2012, with a peak of 83 in 2010. As the search result indicates, the field of partnering research is increasing, peaking in the year 2010, for the initiation of partnering studies in the selected journals; thus, the status of partnering publications in the year is specifically enumerated in Table 2. A more specific search into each of the target journals showed that among the 8222 papers published in the eleven selected journals, 141 (1.73%) addressed partnering subjects or related issues. The statistics in Table 2 show that research on partnering related topics has significantly emerged within the 11 years between 2002 and 2012. The number of papers published on partnering in the target journals between 2007 and 2012 is 88, far more than 54 in the 2002-2006. The data supports that research interests in partnering related topics have been increasing consistently throughout the 11 years which is shown in this study. Evidently, as seen in Table 2, a growing number of

journals has published partnering papers since 2002. The journals Construction Management and Economics, International Journal of Project Management, Engineering, Construction and Architectural Management and Journal of Construction Engineering and Management have within the studied period published the highest number of partnering papers, respectively 36, 30, 23 and 11.

Table 2: Published Partnering Related Papers in Selected Journals

Search engines													
ABI Proquest, Science Direct, Web of Knowledge and Emerald		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total
Search engines		30	31	48	42	58	78	47	59	83	69	67	612
Total published papers		617	640	826	880	874	1044	814	923	936	507	161	8222
Partnering related papers		10	9	11	12	12	24	9	9	17	12	16	141
Distribution %		1.62	1.41	1.33	1.36	1.37	2.30	1.11	0.98	1.82	2.37	9.94	1.71
Journals													
IJPM	Total	83	72	96	77	82	89	90	82	82	103	na	856
	Partnering related papers	4	4	3	2	1	7	0	1	1	5	2	30
	Distribution %	4.82	5.56	3.13	2.60	1.22	7.87	0	1.22	1.22	4.85		3.50
ECAM	Total	76	36	39	35	36	37	36	36	36	36	18	421
	Partnering related papers	0	0	1	3	4	5	2	2	1	2	3	23
	Distribution %	0	0	2.56	8.57	11.11	13.51	5.56	5.56	2.78	5.56	16.67	5.46
CME	Total	60	79	90	88	112	105	97	102	114	78	112	1037
	Partnering related papers	2	2	1	4	2	5	3	4	5	4	4	36
	Distribution %	3.33	2.53	1.11	4.55	1.79	4.76	3.09	3.92	4.39	5.13	3.57	3.47
CI	Total	31	28	25	31	24	20	19	29	25	27	7	266
	Partnering related papers	0	0	2	0	2	1	1	0	0	1	2	9
	Distribution %	0	0	8.00	0	8.33	5.00	5.26	0	0	3.70	28.57	3.38
AIC	Total	59	66	192	85	100	99	107	107	106	120	1	1042
	Partnering related papers	0	0	0	0	0	0	0	1	1	0	0	2
	Distribution %	0	0	0	0	0	0	0	0.93	0.94	0	0	0.19
JCEM	Total	74	94	112	163	165	120	112	157	149	na	2	1148
	Partnering related papers	2	0	2	1	1	0	2	1	1	0	1	11
	Distribution %	2.70	0	1.79	0.61	0.61	0	1.79	0.64	0.67	0	50.00	0.96
SCMAI	Total	32	46	49	159	70	45	48	46	48	42	9	594
	Partnering related papers	1	1	1	1	0	0	0	0	3	0	0	7
	Distribution %	3.13	2.17	2.04	0.63	0	0	0	0	6.25	0	0	1.18
BE	Total	149	143	153	171	209	445	224	272	296	64	7	2133
	Partnering related papers	0	1	0	0	1	2	0	0	0	0	0	4
	Distribution %	0	0.70	0	0	0.48	0.45	0	0	0	0	0	0.19
JFM	Total	24	26	20	19	15	20	20	21	20	19	5	209
	Partnering related papers	0	0	0	1.00	1.00	3.00	0	0	1	0	3	9
	Distribution %	0	0	0	5.26	6.67	15.00	0	0	5.00	0	60.00	4.31
JME	Total	29	23	23	26	27	28	32	38	29	na	na	255
	Partnering related papers	1	1	1	0	0	1	1	0	1	0	1	7
	Distribution %	3.45	4.35	4.35	0	0	3.57	3.13	0	3.45	0	0	2.75
JPSM	Total	na	27	27	26	34	36	29	33	31	18	na	261
	Partnering related papers	0	0	0	0	0	0	0	0	3	1	0	4
	Distribution %	0	0	0	0	0	0	0	0	9.68	5.56	0	1.53

The total number of partnering related papers published in Construction Management and Economics is higher than any of the other selected journals, meaning that Construction Management and Economics has made the greatest contribution to construction in case of partnering related research papers. The data in Table 2 also reveals that the journals AIC and BE published 2 and 4 papers on partnering topics, respectively, only approximately 0.19%, and 0.19% of the total number of papers published in these two journals. These two percentage values are far lower than 0.96% (Journal of Construction Engineering and Management) or higher in other journals. The distinct difference between the selected journals may be conferred to the fact that, even though Automation in Construction and Building and Environment are journals related to construction studies, they barely address the issues concerning partnering in construction according to the scope of coverage stated in the introduction of these two journals.

Research themes in partnering research

Hong et al. (2012) and Li et al. (2000) classify research on partnering before 2000 and now again in 2012, Li et al. (2000) propose in their paper on partnering research in construction that it could be divided into two general groups an empirical and non-empirical study. Both of these categories are divided into four subcategories to generalize the research topics for the empirical studies, namely research on; project partnering, research examining a dual partnering relationship, research having an international focus, and research emphasizing a special application. The non-empirical were divided into the following four topics; being types of partnering, partnering models, partnering processes, and partnering structure. But, with another thirteen years past, the latitude of research on partnering has been extending to a much more wide-ranging level, whereas purely relying on the previously noted principle to identify the research interests in partnering studies is no more comprehensive (Bygballe et al., 2010).

This study identified ten distinctive research themes within the last 11 years by summarizing and differentiating the research interests in partnering papers, that is as follows; (1) Barriers to implementation (Bti), (2) Advantages, inducements of implementation (Aii), (3) Feasibility analysis (Fea), (4) Critical success factors (Csf), (5) Performance measurement, assessment (Pma), (6) Review of development and application (Rda), (7) Strategies and recommendations for implementation (Sri), (8) Supply chain management, use in (Scm), (9) Theory and model (Tam) and (10) Trust (Tru). Deciding on which theme represents the scope of each paper seems uncertain and subjective, in the review it was attempted to be as objective as possible by minimizing or even eliminating any variations in review. An important note here is that the study was conducted merely for comparison purposes. A single paper was only grouped under one main research theme, any papers which covered more than one research theme were fitted in the category by the predominant part. The categorization under the ten themes related to partnering research from the selected journals are shown in Table 3.

An in depth literature review of the published journal papers indicated that exploration into construction partnering primarily involved as follows; (1) examining the use and impact of trust in construction partnering (e.g., Rahman and Kumaraswamy (2012), Davis and Love (2011), Laan et al. (2011), Badenfelt (2010)); (2) Reviewing feasibility and exploring the applicability of adopting the partnering approach to a single construction project or the entire construction

industry of the country or region (e.g., Bower (2002), Lu and Yan (2007), Mohan et al. (2007)); (3) detailing benefits and clarifies the incentives for implementation (e.g., Lu and Hong (2007), Kenneth et al. (2006), Eriksson (2010), Deborah et al. (2012)); (4) highlights barrier to implementation and indicates how these can be overcome (e.g., Pan and Sidwell (2011), Bresnen (2010), Per Erik et al. (2009), Phua (2006), Chan et al. (2003)); (5) providing evaluation, strategies, and recommendations for partnering implementation (e.g., Bresnen (2009), Kadefors et al. (2007), Eriksson (2007), Swan and Malik (2007)). Table 3 shows the main research evolution of the themes discussed by the papers in selected journals.

Table 3: Research Themes of Partnering Related Research

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Total	2002-06	2007-12	Increase %
Theme															
Barriers to implementation	1	2	0	0	1	1	3	1	3	1	0	13	4	9	125%
Advantages, inducements of implementation	2	0	0	0	1	1	0	1	2	1	3	11	3	8	167%
Feasibility analysis	1	0	0	0	0	2	0	0	0	1	0	4	1	3	200%
Critical success factors	1	1	2	2	2	2	0	2	3	1	5	21	8	13	63%
Performance measurement, assessment	0	0	0	0	0	4	3	2	0	0	2	11	0	11	
Review of development and application	1	2	6	3	6	1	0	1	4	4	2	30	18	12	-33%
Strategies and recommendations for implementation	3	0	1	0	0	6	0	1	0	0	0	11	4	7	75%
Supply chain management, use in	0	2	1	4	2	2	0	0	2	0	1	14	9	5	-44%
Theory and model	1	1	1	3	0	2	3	1	1	1	1	15	6	9	50%
Trust	0	1	0	0	0	3	0	0	2	3	2	11	1	10	900%
Total	10	9	11	12	12	24	9	9	17	12	16	141	54	87	61%

As shown in this study of partnering research over the last decade, review of development and application of partnering is becoming moderately mature as exemplified by an increasing amount of published papers after 2007. On the other hand research on trust, feasibility, advantages, inducements of implementation and barriers to implementation is emerging, in which investigation has been conducted by many researchers to set a case example of partnering in construction in recent years.

7 Conclusions and implication for further research

Although implemented without formal contracts, unlike other procurement approaches, partnering has been gaining increasing popularity within the construction industry for achieving better value for money. Along with the development of construction partnering, research into this topic undertaken by academics also emerged in developing the appropriate strategies to partnering

implementation. To explore the research trend on construction partnering this paper conducted a three-stage review of the partnering related papers published, first by using ABI Proquest, Science Direct, Web of Knowledge and Emerald and then afterwards by review of all related papers in the 11 selected construction journals, i.e., International Journal of Project Management, Engineering, Construction and Architectural Management, Construction Management and Economics, Construction Innovation, Automation in Construction, Journal of Construction Engineering and Management-Asce, Supply Chain Management: An International Journal, Building and Environment, Journal of Facilities Management, Journal of Management in Engineering and Journal of Purchasing and Supply Management.

In the era 2002 and 2012, 142 papers related to partnering studies in construction were published in these journals. An in-depth review of the papers indicated that research interests in partnering have been increasing steadily throughout the years, thus taking a turn from a theoretical to at more solution-oriented research on review of partnering development and application as well as benchmarking and overcoming barriers. The new approach to partnering research reflects that the fundamentals of partnering is known, now all we need is to use it (Eriksson, 2010, Bresnen, 2009, Gadde and Dubois, 2010). We are seeing an increasing effort in research on partnering as of which this study provided sufficient evidence but are we seeing and a corresponding increased effect of partnering in construction?

Ten categories were classified as the primary research interests of partnering papers, including (1) Barriers to implementation (Bti), (2) Advantages, inducements of implementation (Aii), (3) Feasibility analysis (Fea), (4) Critical success factors (Csf), (5) Performance measurement, assessment (Pma), (6) Review of development and application (Rda), (7) Strategies and recommendations for implementation (Sri), (8) Supply chain management, use in (Scm), (9) Theory and model (Tam) and (10) Trust (Tru).

Since the review identified a lack of research on the importance of developing trust among construction partners to facilitate project success which truly accords with and meets the objectives of partnering through cooperation and teamwork future studies should aim to fill this void. But also further studies on the question of feasibility and the barriers to adopting the partnering approach and strategic propositions for overcoming potential barriers would facilitate in enlarging the scope of partnering application worldwide. The overview provided in this study should provide a solid reference platform for researchers to gain more insight into partnering related issues and trends, thus an overview of the development of construction partnering in the academic field were gaps and new trends in partnering research, as referred to previously, provide promising ideas for future researchers to exploit. It is hoped that the analysis will provide some guidance for further research in making appropriate decisions and broadening their scopes when conducting research and writing academic publications. It is also recommended that a similar study is repeated in every five years; so that the development of partnering related research can be monitored and the research trends reviewed, hence, possibly find more international contributions to the field and some shifts of research trend.

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Use of KPIs to Regulate Co-operation and to Improve Inter-company Benchmarking in the Construction Industry

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Abstract

With the aim to investigate whether it can fairly be assumed that the prequalification and selection of co-operators via Key Performance Indicators (KPI) provide increased odds in favour of success, a study on contractors consisting of benchmark results from The Benchmark Centre for the Danish Construction Sector and financial statements has been accomplished. Through a comparative analysis based on detected correlations between economy and KPIs, it is explained how these factors are linked. The research showed that the use of KPIs has motivated companies to improve their competitive ability, thus their ability to become prequalified. It also showed that the use of KPIs (e.g. quality, timeliness, economy, customer satisfaction and accident rates) for selection and prequalification improves the probability of success in the building process as highly rated KPIs have a positive linear relationship with the company's financial stability and customer satisfaction.

Keywords

Construction regulation, Construction legislation, Benchmarking, Effectiveness, Efficiency.

Introduction

The construction industry and particularly the Danish building sector have been subject to severe criticism in public debate, from the Danish government as well as from customers. The building sector is frequently described as conservative and tradition-bound, which according to critics results in little innovation, a not very efficient and effective cooperation and bad economy compared with other industries (Akintola, et al. 2000, Cheung, et al. 2009, Dansk Byggeri 2006, Kadefors 2004, Wandahl, Cankaya et al. 2011). The criticism has included low growth in labour productivity due to lack of transparency in the bidding process which restricts competition, low perceived quality-price relationship, many defects, displeased customers and too many accidents and fatalities (Dansk Byggeri 2006).

As a result of the criticism the Danish Housing and Urban Affairs Committee and the Danish Agency for Trade and Industry proposed that the establishment of a benchmark agency would enhance transparency and quality-cost relationship, introduce inter-company benchmarking and enable construction clients to choose the best partners (By- og Boligministeriet 2000). The Danish construction industry has therefore since 2004 been regulated by the state in attempts to obtain the above-mentioned outcome. The legislation constitutes by law the use of KPIs. The

statutory orders apply to public sector construction-projects since 2004, social housing and institutions that have received at least 50 per cent in operating subsidies from the state since 2007.

In recent years the Danish construction industry has earned the reputation of being a low-level and tradition bound industry focusing on short-term gains, instead of long-term planning of development and innovation (BEC 2010, Manley *et al.* 2009). The recession has forced major construction clients to review their priorities and relationships with contractors. In an economic upswing it is much easier to promote collaborative working e.g. alternative selection and assignment criteria in construction because it provides good value for money for the client and profit for the seller thus making the “pie” bigger (Jones and O'Brien, 2003). Now, when in recession, the contractors as well as the clients are going back to competitive (price) tendering because the client assumes it would provide more value for money for the client (Horta *et al.* 2010).

Due to the oppressive financial crisis it is particularly relevant to consider the possibilities of increasing businesses competitive advantage where it is necessary with innovative thinking to break with tradition (Han *et al.*, 2010 and Miozzo and Dewick, 2002). Uninhibited innovation is not the path to success, the right innovative approaches carefully selected are thus innovations which can provide the critical component of a firm's competitive strategy (Manley *et al.* 2009 and Miozzo and Dewick, 2002). To break the cycle, thus going from tradition to innovation, the Danish Ministry of Housing and Urban Affairs and the Danish Agency for Trade and Industry embodied in December 2000 the criticism in the report “The Danish Construction Sector in the Future”. Among various solutions it was suggested to establish a Benchmark Centre for the Danish Construction Sector for which the main purpose was to enhance transparency in the market by introducing a benchmarking system. Later in 2001 a collaboration between clients, contractors, consulting engineers, architects, employees, manufacturers of building materials and the Danish Government decided to set up The Benchmark Centre for the Danish Construction Sector (BEC). Future development of the system and governmental regulations were in the years after conducted producing several adjustments for improved use, the following actions were carried out:

- August 2003, the Danish Government made construction benchmarking compulsory for Danish State construction projects in excess of 5 million Danish Kroner (DKK) with effect from 1 January 2004 as part of its overall construction policy embodied in Statutory Order No. 1135 dated 15 December 2003
- July 2005, all contractors bidding for Danish State construction projects must substantiate their capabilities in the form of KPIs including customer satisfaction, defects, compliance with time schedule and health and safety at the workplace.
- February 2007, benchmarking of social housing construction projects in excess of 5 million Danish Kroner embodied in Statutory Order No. 136 dated 9 February 2007
- May 2008, all requirements were extended to architects and consulting engineers.
- January 2010, the clients within the State and social housing areas were included in the benchmarking system.

The use of KPIs by statutory orders applies to all public sector clients whose construction projects are comprehended by the Government Construction Act No. 228 dated 19 May 1971 State's construction as amended by Section 3 of Act No. 484 dated 9 June 2004 and Section 1 of Act No. 413 dated 1 June 2005 or Social housing Acts No. 1204 dated 10 December 2009 on Social Housing and Act No. 786 dated 18 August 2009 on Social Dwellings for the Elderly. The Statutory Orders also apply to institutions that receive at least 50 per cent in operating subsidies from the State. Infrastructure projects are not encompassed by the Government Construction Act and, consequently, are not covered by the Statutory Orders. The purpose of the Construction Benchmarking System is to enhance transparency in the market and to enable the participating parties in the construction process to choose the best business partners and to provide a basis which enables individual client and company to benchmark themselves against one another and to learn from best practice.

The research subject is competitive advantage in the construction industry. The subject is inspired by previous projects, which mainly had a focus on companies' particular ability to create a good business both internally and externally by altering strategic processes through innovative initiatives (Han et al., 2010 and Miozzo and Dewick, 2002), which led to the questions of whether there is a measurable correlation between the introduction of the benchmarking system e.g. the use of KPIs (e.g. quality, timeliness, economy, customer satisfaction and accident rates) for selection and prequalification and 1) improvement of the probability of success in the building process and 2) company's financial stability. The correlation between KPIs, financial stability and probability of success in the building process is therefore examined in the paper, thus addressing the following:

- Relationship between company size and ability to create a profit margin
- Relationship between company size and ability to create satisfied customers
- Relationship between customer satisfaction and economic stability, thus implying that a correlation between satisfied customers and ability to create long-term profit benefits the company's probability for success in the building sector

Research methodology and methods

In the methodological considerations a technical/social science methodologies approach was chosen, this research methodology encompasses the rationale and the philosophical assumptions that underlie the study. The choice of research strategy drastically influences the specification of the research methods which are deployed for investigating a problem and determine the research design, namely the framework for collecting, analyzing and interpreting data (Dainty, 2008). This approach was chosen since research in construction management differs significantly from other disciplines since the latter is not an academic discipline in its own, with research techniques and theories, but rather builds upon theoretical models developed elsewhere in the social sciences (Hughes, 1994). The objective of this study is to critically review the relationship between customer satisfaction and economic stability irrespective of the adopted approach, a challenge was the formulation of a concise and generic set of criteria for the evaluation of all types of research efforts included in the analysis. The ontological position in this study is "objectivist ontology" which evaluates social phenomena independently of the

social actions (usually associated with the quantitative approach) (Dainty, 2008). Epistemology refers to what should be regarded as acceptable knowledge in a discipline and is here characterized by a positivist (quantitative) perspective (Dainty, 2008). Further, a mixed-method approach was used associated with the deployment of quantitative techniques for data elicitation and analysis respectively. With a mixed-method design empirical work or archival study is combined with quantitative modeling of company data for the formulation of statistical regression.

The first section consists of the following quantitative analysis groups; analysis of KPIs, economic analysis. The second section consists of a comparative analysis based on the detected correlations between economy and KPIs as well as probability for success in the building process and KPIs, where it is argued that high KPI values correspond to correlations between success rate in the building process and financial stability. To illustrate the relations between the selected analyses groups proposed in this research, a graphical representation can be seen in Figure 1. The different parts in Figure 1 will in the following be explained in different paragraphs to gain a better insight.

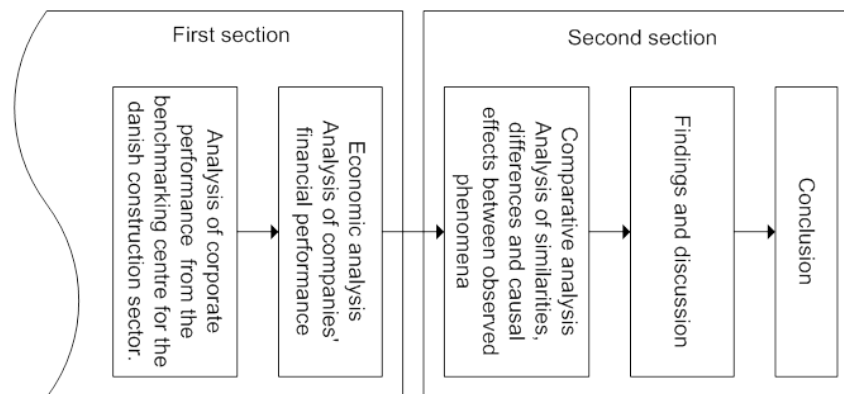


Figure 1 - Illustration of the methodology and elements in the analysis.

Sample

The empirical study was geographically bounded only to consider members of The Benchmarking Centre for the Danish Construction (BEC) in North Jutland, and furthermore to the construction, carpentry-, and masonry contractors, this sector breakdown consists of companies with the same level of profit margin in the same region of Denmark for a better comparison. In order to carry out the research, it was necessary to choose a sample of companies which have been involved in at least one evaluation case and for which the KPIs are required by statutory orders. This was done by using BEC's database, in which 42 firms were found distributed throughout North Jutland which complied with the characteristics required for the research. From the total of 42 firms from the database, 2 discontinued due to incorrect/or no contact information or the fact that the firm had disappeared, and a total of 26 firms that, despite forming a part of the base consulted, declared that they did not fit the profile of the study as defined in the covering letter sent to inform about the inquiry. The total number of respondents successfully contacted and from which it was possible to obtain correctly completed grade books with KPIs came down to 14. Due to anonymity the firms were alphanumerically numbered from A - N, and classified in the following sizes; small (1-19 employees), medium (20-49

employees) and large (50-199 employees) in order to identify whether the size is significant.

Economic analysis

In order to assess the economic conditions of the firms a financial evaluation of the annual financial statements were conducted. The financial statements Commerce and Companies Agency, all of which are based on the traditional accounting model, also known as the annual periodic model where the focus is on signifying the liquidity of the companies, the income and expenses in a given accounting period of 12 months was shown. The financial analysis was used to evaluate a given company's financial performance within a limited time of 5 years. Because this analysis is limited to public accounts, it was necessary to make individual assessments of the businesses in order to ensure a comparable result. Result of a financial analysis is a number of measuring points which characterize the company in a given accounting period.

Customer satisfaction analysis

A company receives a factsheet for each evaluation with the KPIs which have been calculated for a particular task. The company's grade book contains the average of each KPI in the company's valid factsheet history going back three years. When calculating the grade book the KPIs from each factsheet are weighted with the contract price of the particular task (BEC 2012).



Figure 2 - Basic principle behind factsheets and Grade book (BEC 2012).

An examination of different company sizes' ability to meet and satisfy customer's requirements will make the basis for assessing the success of the construction projects. When distributing the inquiry letter permission to inspect corporate grade books character from The Benchmarking Centre was asked. A grade book contains general information about the company, the cases, customer, building type, time and performance. The summary of corporate performance is presented in four categories, deadlines, constraints, work accidents and customer satisfaction on a scale from A to E (5-1), where A(5) is best. In this analysis the focus was on the customer's assessment of the companies. It is hereby meant customer satisfaction because this tells about; satisfaction of the process, build quality, end product etc., in the form of two calculated and weighted averages.

Comparative analysis

In order to compare data groups a comparative method was used which sought to explain similarities and differences between the observed phenomena within a defined area of analysis (Bryman 2008). Here, the method was used to investigate correlations between phenomena and the context in which they exist. For example,

on the basis of detected context in the correlation between the introduction of the benchmarking system for selection and prequalification and improvement of the probability for success in the building process and how it reflects on the company's financial stability, thus implying that a correlation between satisfied customers and ability to create long-term profit benefits the company's probability for success in the building sector as seen in Figure 3.

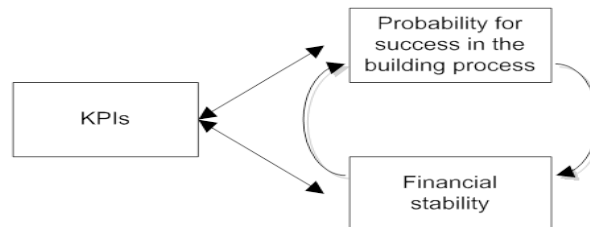


Figure 3 - Illustration of the methodology and elements in the comparative analysis.

Findings and discussion

It was chosen to calculate the standard deviation of the individual businesses financial performers across the five years period, see Table 1. This was done because of large fluctuations in the companies' economic performance. Standard deviation is an expression of fluctuations from year to year's average. Calculating the variance and deviation attention must be paid to an overall positive or negative development in the company's performance. By calculating the standard deviation, see Table 1, it was found that the large firm (5.4 percentage points) achieved the smallest deviation from the total average. For the remaining segments the deviations were for small (6.5 percentage points) and medium (10.8 percentage points). Despite large fluctuations in return on capital employed (ROI) the standard deviation, see Table 2 which shows that large firms have greater stability in return on capital employed (ROI) (8.4 points), compared with the medium (13.7 percentage points) and small (19.6 points). The relatively stable but downward trend among the large firms seen in Table 2 where the large companies as well as the remaining segments reduce their return on capital employed (ROI) in the critical years. By calculating the standard deviation, a decreased spread in return on equity between segments was found. Large firms (26.9 percentage points) achieve the highest stability, followed by medium (29.5 percentage points), and the small players (30.1 points). The observed low standard deviation of solvency ratio for large firms (6.6 points), medium (8.0 percentage points) and small (9.4 percentage points) testifies that the market is under pressure. Expectedly the high competition in the market provides continuous smooth solvency ratio and low standard deviations. However, the tendency for large companies is less deviant for the total average. Overall, large companies got the lowest standard deviations in four out of six categories, see Table 1. It was therefore found that the large companies outperform the rest of the segments with only a few fluctuations in the annual results.

Customer satisfaction analysis

In the customer satisfaction analysis it was found that the largest companies with average rating (4.68 points) outperform the remaining segments with a higher

average than the medium (4.24 points) and smaller companies (4.44 points), see Table 2. Furthermore, it appears that the largest companies do much better in customer evaluation, see Table 2 (weighted average 2), where large companies by 4.6 points on average scores 0.4 points above the small (4.2 points) and 0.9 points above the medium-sized businesses which receive 3.7 points. Generally the outcome of the selected companies coincides with the average of the 366 companies compiled by the Benchmark Centre for the Danish Construction Sector itself. The largest companies differentiate themselves positively in all areas except loyalty. The reason may be found in the markets for small businesses where they typically have a propensity to act in smaller communities or in collaboration with the same great primary or general contractor.

Table 1 - Standard deviation for the economic analysis where lower value means lower fluctuations thus better financial stability.

	Contribution ratio (%)	Profit ratio (%)	Return on capital employed (%)	Return on equity (%)	Solvency ratio (%)	Safety margin (%)
Company	Standard deviation (percentage point)					
Average small business 1-19 Employees	6.1	6.5	19.6	30.1	9.4	18.1
Average medium business 20-49 Employees	11.3	10.8	13.7	29.5	8.0	49.3
Average large business 50-199 Employees	5.1	5.4	8.4	26.9	6.6	31.8

Table 2 – Business performers from The Benchmark Centre for the Danish Construction Sector, the scale goes from 1-5, where 5 is best.

	Measuring points			Customer satisfaction	
Company	Deadlines	Deficiencies	Accidents	Process	Loyalty
Small business 1-19 Employees. Average: 4.44	5.0	3.6	5.0	4.0	4.6
Medium business 20-49 Employees. Average: 4.24	5.0	3.8	4.9	3.6	3.9
Large business 49-199 Employees. Average: 4.68	4.9	4.4	5.0	4.6	4.5
BEC Average	5	4	5	3.8	4.4

Comparative analysis

When comparing results from the customer satisfaction analysis and financial analysis, it is possible to divide all segments into two new categories; most successful companies and less successful companies which also contain a representation of the company's ability to create financial stability. This compilation can be seen in Table 3. Based on this consideration, the companies were divided into categories based on earnings in the five-year period and on customer satisfaction, where the standard deviation of their economic performing was used as a measure for assessment. It was then found that the category of most successful companies included in majority large companies with 50 to 199 employees (67%) see Table 3.

Table 3 - Comparison of the results from the customer satisfaction analysis and financial analysis, the stars represent the rating i.e. rating of 0-1.4x equals one star and 1.50-2.4x equals two stars etc.

Company no.	Customer sat.	Economical std. dev.	Overall assessment
M (large)	5.00 *****	5.00 *****	5.00 *****
K (large)	5.00 *****	4.78 *****	4.89 *****
C (small)	4.77 *****	4.88 *****	4.82 *****
J (large)	4.99 *****	4.10 *****	4.54 *****
I (medium)	3.30 ***	4.57 *****	3.94 ***
N (large)	3.50 ***	4.23 *****	3.87 ***
G (medium)	3.90 ***	3.52 ***	3.71 ***
H (medium)	3.80 ***	3.04 **	3.42 **
D (small)	4.07 *****	2.72 **	3.39 **
L (small)	3.51 ***	2.88 **	3.20 **
F (medium)	3.40 **	1.20 *	2.30 *
E (medium)	3.54 **	1.01 *	2.27 *
A* (small)	-	4.32 *****	2.16 *
B* (small)	3.67 ***	-	1.83 *

Conclusion

The results of the survey reflected a tendency between customer satisfaction and economic stability, therefore a tendency showing that financially stable companies provide stable customer satisfaction and vice versa providing improved probability of success in the building process, as illustrated in Figure 4 based on Table 3.

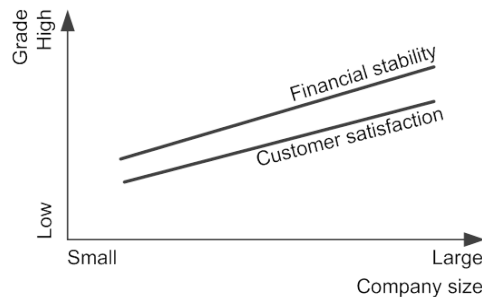


Figure 4 - Illustration of the tendency between customer satisfaction and economic stability, data drawn from Table 3.

Today various institutes of the country's universities do research on the topics as treated in the paper. As this paper is based on data only collected from North Jutland, it would be necessary and useful to see whether the result can be replicated on a national or international scale. It is therefore recommended to extend the study internationally by comparing the Danish construction industry with construction industry in other countries. In further research of the subject, it would probably be possible to make a stronger statement about the innovative focus areas, and the argument for how innovative proceedings are related and could be substantiated.

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Construction Projects Focus on Evaluation and Its Benefits by Pre-planning

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Abstract

Evaluation and pre-planning are two critical factors which give the project organization and project manager the opportunity to plan, and avoid unexpected situations in the construction process before it starts. The aim of this study is to answer the following two questions: how often are evaluations carried out? And which trade group focus most on evaluations? The study is based on a questionnaire survey for the most common trade groups in the Danish construction industry, where 167 respondents completed the survey. Findings indicate that the architect's has most focus on evaluation in both internal and external project association; and evaluation has a minor focus for all the respondents where 64.5 % answer that they never, or rarely evaluate; and only a third 34.9 % of the respondents indicate that they evaluate sometimes or frequently.

Keywords

Construction project management, Planning, Pre-planning, Evaluation.

Introduction

Evaluation and pre-planning are two critical factors which give the project manager and the project organization the opportunity to plan, and avoid variables and unexpected situations in the construction process before it starts (Hanna et al. 2010; Gibson Jr. et al. 2006; Johansen et al. 2006; and Hwang et al. 2012). It is therefore crucial that the project organization evaluates, after a project completion to learn and understand which complications and optimization opportunities there have occurred during the project, and which factors and tools there can be used in future projects to reduce risk, duration and cost to improve the quality (Puddicombe 2006; Drejer et al. 2006). The main purpose of an evaluation and pre-planning is therefore to improve the productivity in an effective way which can raise the economical profit without reducing the quality (Barker 2004).

The stagnant labor productivity in the construction sector is also an international challenge, where researchers within labor productivity for several years discussed whether the labor productivity in fact is declining (Strokes Jr. 1981; Ranasinghe et al. 2012; and Abdel-Wahab et al. 2011) or improving (Goodrum et al. 2002; Dai et al. 2009). Other research addresses what productivity measurement method is representative for the construction process (Rojas et al. 2003; Crawford et al. 2006; Kim et al. 2011; Bröchner et al. 2012; Park et al. 2005; and Goodrum et al. 2002), based on the theory that the construction sector has special processes (Gann 1996) or not (Strokes Jr. 1981; Winch 2003).

To improve the labor productivity in the construction process, researchers have addressed whatever more focus on pre-planning of risk and project management can reduce cost, shorten schedule and improve labor productivity (Thomas et al. 2007; Gibson Jr. et al. 2006; Barker 2004; Ford et al. 2004; Hastak et al. 2008; Schatteman et al. 2008). Studies have shown that duration can be reduced by approximately 20 % to 30 % (Thomas et al. 2007; Hastak et al. 2008; Barker 2004), where risk and project management can stimulate the success rate of the construction process by making more efficient risk and project management (Dey 2010; Gibson Jr. et al. 2006). Further studies have indicated that focus on technology and project performance has a beneficial impact (Goodrum et al. 2011; O'Connor et al. 2004; Li et al. 2009; and Allen et al. 2008) together with changes in material technology by lighter products (Goodrum et al. 2009), where prefabricated building systems can have a positive impact on the productivity (Richard 2005; Jaillon et al. 2009; Thusen et al. 2011; and Li et al. 2011).

But even though scientific results have proved that focus on the industrialized construction process can have a positive impact on the industry's labor productivity (Gibson Jr. et al. 2006), it is still a challenge that the labor productivity is stagnant or improved like within others sectors.

The rationale for this paper is to study the construction industry's focus on evaluation after completion in both the external and internal project organisations, and find benefits from pre-planning to avoid unexpected complications in future planning and construction processes. The study area is defined as the construction industry in the geographical area Aarhus and Aalborg in Denmark where the most commonly used trade groups in such projects are owners / developers, client design advisors, architects, engineers, and contractors. The aim of this paper is to answer the following two questions: how often are evaluations carried out? And which trade group focus most on evaluations?

Related work

Looking at the related work from the last decade, there are several studies related to the field. The first article is a study from Aalborg University, Department of Business Studies and carried out by Ina Drejer and Anker Lund Vinding (2006). The study is conducted using a survey dataset generated in 2003, as being a part of a national research project to design and create better and cheaper building activities in Denmark.

The purpose of the study was to find how knowledge and innovation is acknowledged in the construction organizations. Findings indicate that the temporary relations in construction projects can present a problem with continuous learning at firm level, because no mechanisms to transfer experience and learning between project and firm exist. Further it is found that architects and consulting engineers are the trades groups in the construction industry which most likely is engage in innovative activities.

Finally it is stated that use of post-project review and systematic evaluation may imply that the managers has less challenges in combining short term tasks with long term learning and knowledge sharing.

The second article is a study from Norwich University, Division of Business and Management, and is carried out by Michael S. Puddicombe (2006). The study consists of a case study, interview, and a survey where the respondents are general

contractors, architects and owners. The purpose of the study, hypothesis one was to find if early planning is associated with high performance in high complexity projects, and hypothesis two if collaborative behavior is positively associated with high performance, and finally hypothesis three if early joint action is positively associated with joint action during project.

Findings indicate that hypothesis one is fairly complex, but there is no significant relationship between quality and cost associated with pre-planning.

Hypothesis two is found positive with collaborative behavior for high performance in the construction process, but not for collaborative behavior in preconstruction. Hypothesis three found strong supports between all three perspectives and that preconstruction planning exist where the effort by partnering has a significant impact on the joint action during project.

Finally it is stated that findings indicate that the planning process not always is a vehicle for superior performance but needs to be reconceptualized by recognizing the limitations and requirements in pre- construction.

Research Methodology

The methodology applies a questionnaire survey for medium (20 – 49 employees) and large-sized (49 – 199 employees) companies related to the construction industry, conducted in the Danish region Jutland's two largest cities Aarhus and Aalborg in the period 7 March 2012 to 21 March 2012. The respondents were asked to participate based on the company profession which is normally used in a construction project. Five different trade groups were identified as typical, involved trade groups; owners / developers, client design advisors, architects, engineers, and contractors.

The companies' head of department was first contacted by phone to present the study and its aim, afterwards the head of department sent e-mail addresses on five employees, who were suited for the task based on their daily work in contact with the five trade groups. This strategy to maximize the replays was conducted to secure a high rate of both qualified respondents and respondent's rate in general. We succeeded in getting 183 possible respondents. For the companies where it was not possible to contact the head of department to present the study purpose etc., a qualified employee was contacted based on the company website and the employee's position, we succeeded in getting further 24 possible respondents.

The questionnaire survey was conducted digitally using the software program SurveyXact where the main parts of questions were closed check mark answers to make the reply easier for respondents. At the end of the survey it was possible to make a comment if the respondents had further information or comments.

The data analysis of the questionnaire survey was conducted using the software program Microsoft Excel, where the closed check mark answers were converted from nominal scale to ordinal scale to find out which trade group had the highest focus on evaluation; "never" goes from 0.00 – 0.95, "rarely" 0.95 – 1.95, "sometimes" 1.95 – 2.95, and "frequently" 2.95 – 3.95. The results are presented in Table 15 where the answers to the single question and the profession were calculated as grouped mean by observations. The mean per profession and question was calculated as arithmetic mean. Hereafter is the arithmetic mean for all six

questions and trade groups calculated, and the standard error was calculated based on the standard deviation to find out how much focus evaluation got, see Fig 1.

Results

The questionnaire survey was sent by mail to 207 potential respondents of whom 167 completed the survey which gave a response rate of 81 %, 18 % did not respond and 1 % did partially complete the survey. The response rate per trade group is listed in Table, where the response rate is going from the lowest 15.0 % client design advisors to the highest of 24.0 % for the contractors, which is a reasonable responds rate per trade group if they are approximately equal.

The geographical balance is equal among the 167 respondents where 49.1 % from the Aalborg area and 50.9 % were from the Aarhus area. The distribution of gender in the survey was 83.8 % men and 16.2 % women, where the respondents' age was in the age from under 30 years old 6.6 %, to over 60 years old 10.8 %, and the age from 30 to 40 years old was the segment with most respondents 32.9 %, followed by age segments 40 to 50 years old 26.9 %, and 50 to 60 years old 22.8 %. The respondents' seniority in the construction industry represented 10.2 % under 5 years, 17.4 % had between 5 to 10 years, and 72.5 % had over 10 years seniority in the industry.

Looking at the respondents' reply to all six questions independently of trade groups to find out how much focus evaluation gets see Fig 1, where all replies are presented as an arithmetic mean of all six questions, with standard error for each category. The results from all trade groups are sorted in the category "never" 32.3 %, "rarely" 32.2 %, "sometimes" 27.4 %, "frequently" 7.5 %, and "don't know" 0.5 %. The questionnaire survey results indicate that the focus on evaluation for all asked trade groups is concentrated in the categories "never", and "rarely" which together account for 64.5 % of the respondents, and only a third of the respondents indicate that they focus on evaluation in the segments "sometimes" and "frequently" 34.9 %.

The grouped mean results for the questionnaire survey are presented in Table 15 where all six questions are sorted per profession to the ordinal scale. It was found that all trade groups have an arithmetic mean on all questions in the segment "sometimes" 1.95 – 2.95 and the trade groups use the segment "sometimes" from the lowest 1.99 by the owner / developers to the highest 2.34 architects, and the client design advisor by 2.07, engineers 2.08, and contractors 2.07 seems to agree by a mean difference of only 0.1 for all six questions. The results can therefore be further categorized in three groups where owners / developers have the least focus, client design advisors, engineers, and contractors have a medium focus and the architects have the strongest focus for the six asked questions.

Looking at the arithmetic mean values per asked question was it found to be in the segments "rarely" 0.95 – 1.95 and "sometimes" 1.95 – 2.95, where the trade groups have indicated a focus from 1.92 as the lowest and 2.36 as the highest. The result indicates that the internal evaluation, participation, and feedback are in the segment "sometimes", but the feedbacks from these evaluation meetings are receiving a minor focus. The result in external evaluation meetings is in the lower end of the segment "sometimes", where participation and feedback is in the higher end of the segment "rarely".

Results of the grouped mean questionnaire survey also indicate that the internal evaluation is receiving more focus than the external evaluation, but the feedback in both external and internal receiving lower focus from all trade groups.

Table 1: Survey respondents categorized by profession (Survey respondents)

Profession	Number	Cumulative number	Percentages	Cumulative percentages
Owners / developers	35	35	21.0 %	21.0 %
Client design advisors	25	60	15.0 %	36.0 %
Architects	28	88	16.8 %	52.8 %
Engineers	38	126	22.8 %	75.6 %
Contractors	41	167	24.0 %	100 %

Table 15: Grouped mean results for the questionnaire survey by asked question and trade groups, “never” goes from 0.00 – 0.95, “rarely” 0.95 – 1.95, “sometimes” 1.95 – 2.95, and “frequently” 2.95 – 3.95 (Grouped mean results)

	Owners / developers	Client design advisors	Architects	Engineers	Contractors	Mean per question
Have you been invited to evaluation internal in your firm?	2.09	2.16	2.71	2.42	2.05	2.29
Have you participate in evaluation internal in your firm?	2.11	2.24	2.75	2.42	2.29	2.36
Have you received feedback on evaluation internal in your firm?	1.97	2.12	2.46	2.35	1.98	2.18
Have you been invited to evaluation where other trade groups have participated?	2.00	1.92	2.04	1.76	2.12	1.97
Have you participated in evaluating where other trade groups have participated?	1.91	2.00	2.07	1.73	2.00	1.94
Have you received feedback on evaluation where other trade groups have participated?	1.86	1.96	2.00	1.81	1.98	1.92
Mean per profession	1.99	2.07	2.34	2.08	2.07	2.11

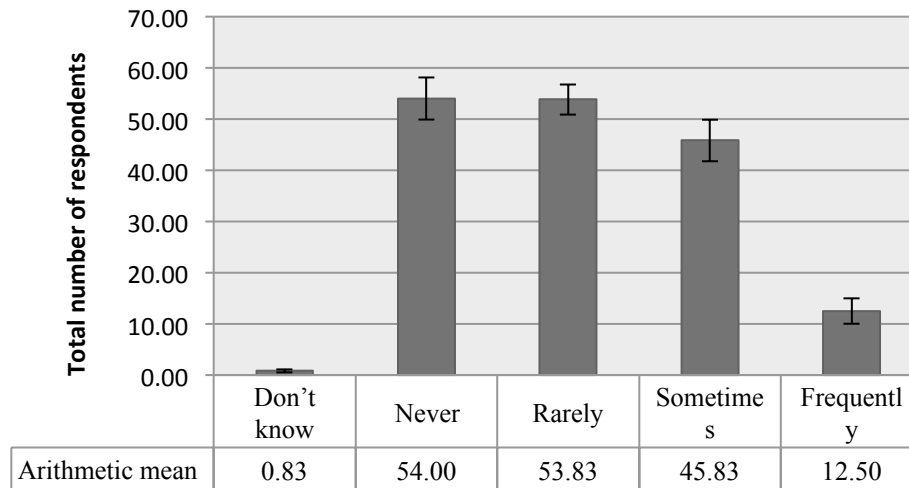


Fig. 1– Arithmetic mean of total respondents' and all six questions, with standard errors (Standard errors for respondents)

Discussion

Comparing results to the related work a similar pattern of findings can be identified. It was found by Ina Drejer and Anker Lund Vinding (2006) whose study was in the same geographic area as this study. They find that the architects and consulting engineers are the two trade groups which most likely to be engaged in innovative activities, and further it is found that no mechanism to transfer experience and learning between project and firm exists. These results can be additionally conformed to this study, where it also was found that architects and engineers were the two trade groups with most focus on evaluation.

Further it was found that the client design advisors and contractors in this study only are 0.1 differences between them and the engineers, so if it is the engineers there have a minor focus now compared to the study by Ina Drejer and Anker Lund Vinding (2006), or it is the client design advisor and contractor there have a larger focus is not possible to tell. Further it was found that 64.5 % of the respondents “never” or “rarely” evaluated, which indicated the same findings as Ina Drejer and Anker Lund Vinding (2006). The missing project to firm level is further confirmed by this study, where it is found that internal evaluation receives more focus then the external evaluation. But the feedback in both external and internal receives lower focus from all trade groups in the survey.

Looking at the results in a pre-planning perspective it leads to the two questions: how can a project and process be improved if not evaluation is attached focus from the trade groups? And is it conceivable that pre-planning do not receive focus before a project is started, if evaluation is carried out at all?

The related article by Michael S. Puddicombe (2006) studied if early planning is associated with high performance in high complexity projects, and if collaborative behavior is positively associated with high performance, and finally if early joint action is positively associated with joint action during project. He finds that there is no significant relationship between quality and cost associated with pre-planning, but there is significant impact on preconstruction planning and the effort by partnering at the joint action during project. This can indicate that a single focus on only preconstruction planning and the learning from earlier projects in a static

perspective not necessarily gives a high performance with improved quality and reduced cost. Further indicates results that a correlation between the different trade groups' commitment and a focus on evaluation and learning from the past where it is incorporated in a pre-planning process together will improve the construction processes.

Conclusion

In this paper it is studied how often evaluation is carried out, and which trade groups focuses most on evaluation. It was found that evaluation independently of the asked trade groups 64.5 % of the respondents, “never” ore “rarely” evaluate after a completed project, and a third 34.9 % evaluated “sometimes” ore “frequently” after completed project.

Further, it was found that the architects trade group had most focus on evaluation, and client design advisors, engineers, and contractors had a medium focus, follow by the owner / developer group which had the lowest focus on evaluation.

Finally the data indicated that the internal evaluation received more focus than external evaluation, but the feedback in both external and internal evaluations received lower focus from all trade groups. The basis and requisite for the findings were based on a relativity small geographic area in the two largest cities in region Jutland, Aarhus and Aalborg, where all participating companies in the survey were medium and large-sized companies. This was also a limitation for the study given that a lager geographic area as for example a national area and all sizes of companies would fortify the findings. Further the questionnaire survey would be improved if the survey was expanded to extra in-depth questions.

Further Research

Today several institutes and universities do research in the topics as studied in this paper. Since the study is based on survey data from just Aarhus and Aalborg in the Jutland region it would be necessary and useful to conduct a similar survey on national and international scale. Further it is also recommended to make a literature review on the missing focus on pre-planning, evaluation and benefits for the construction process, to find the underlying factors of why it has so little focus in the construction industry.

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User Involvement at the Early Stages of Design: a Case Study in Healthcare

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Abstract

This paper reports on the preliminary outcomes of a postgraduate research about user involvement in healthcare design. The purpose of this study is to find ways to promote user participation in healthcare design. A literature review was carried out to outline the state-of-the-art of user involvement in the design process, focusing on its importance, forms of involvement, difficulties and benefits. A case study approach was used to investigate these issues with respect to healthcare design in particular, aiming to understand how designers can include users in the design process and to reveal their difficulties and benefits. The case study was conducted at a Brazilian architecture company specialized in healthcare design. Data were collected by interviews, archival records and document analysis. Preliminary findings indicate the importance of users in defining flows and activities of service design and show that efforts made in the way of simplifying the design representation facilitate user involvement in the design process.

Keywords

Briefing, Concept Design, Healthcare Design, User Involvement.

Introduction

The design of healthcare buildings is complex due to myriad factors relating to the quality of the physical space as well as to the need to improve the delivery of care services (Caixeta & Fabricio, 2012; Tzortzopoulos, Codinhoto, Kagioglou, Rooke, & Koskela, 2009). Hospitals differ from one another, since its buildings, staff, patients, patrons and missions are distinctive. Therefore, the idea of a generic hospital is an abstraction (Risse, 1999); every healthcare building may have a unique vision guiding its construction (Bromley, 2012).

Healthcare service delivery and building design need to be aligned in order to enable new ways of working, to deliver patient-focused environments and to redesign care (Tzortzopoulos et al., 2009). There is growing recognition that excellent medical care cannot be provided just through clinical knowledge, supported by technology and pharmaceutical knowledge. It also demands knowledge and skills on healthcare as service and production, what is the practical business to organize and provide care (Koskela, Rooke, Codinhoto, & Kagioglou, 2012).

In this context, user involvement in the healthcare design process can help designers to understand how service activities are performed. Furthermore, participatory

approaches in early design, when changes are more feasible, can assist designers in capturing real needs of users (Damodaran, 1996; Jensen, 2011; Kujala, 2003). It is important that designers fully understand the client values to ensure high achievement of client expectations or to avoid significant changes during the design process, which can bring frustration among designers and increase project costs (Thyssen, Emmitt, Bonke, & Kirk-Christoffersen, 2010). However, as a rule, users are not familiar with the design language and representations used by architects, and are seldom prepared to contribute the necessary data to the process, which hinders their participation (Reich, Konda, Monarch, Levy, & Subrahmanian, 1996; Tzortzopoulos, Cooper, Chan, & Kagioglou, 2006).

The aim of this paper is to study ways to facilitate user participation in healthcare design, based on the preliminary outcomes of a postgraduate research about user involvement in the design of healthcare buildings. The research method includes a literature review and a case study at a Brazilian architecture company specialized in designing healthcare buildings.

Initially, this paper presents a succinct literature review about user involvement in design process, followed by a description of the research method used. Next, the results of the case study are presented and discussed and a conclusion is drawn.

User Involvement - Benefits and Risks

Designing healthcare buildings demands a multidisciplinary team, composed of experts in design, building structure, facilities, among others. In this context, the involvement of users, in the role of “experts on their own experiences” (Sleeswijk Visser, Stappers, Lugt, & Sanders, 2005), can contribute important information about the uses of the building to the design process. So, user involvement during the design process is crucial to properly identify their ever-evolving needs, expectations, preferences and requirements and ensure their high-quality performance in the future building (Sfandyarifard & Tzortzopoulos, 2011; Steen, Kuijt-Evers, & Klok, 2007; Stern et al., 2003). In addition, participatory design contributes to the legitimization and justification of decisions and may avoid later disagreements with respect to the design outcomes (Olsson, Blakstad, & Hansen, 2010).

Nevertheless, involving users in the design process requires more from designers than the traditional design does. Participatory approaches demands that designers open up the process so as to bring decision making into public discussion. To do so, designers need more self-confidence than they do in a design process without user involvement, in which decision making occurs at an intuitive and internal level. Therefore, involving users as co-designers is not an easy task for designers, since much of the design quality depends on their ability as educators, not only on their designing skills (Johnson, 1979). Professionals engaged in user involvement in service design have to turn users’ ideas into viable ones, which requires that these professionals possess several competencies and knowledge about many disciplines, such as sociology, psychology, usability, marketing, engineering, among others (Magnusson, Matthing, & Kristensson, 2003). Furthermore, some authors discuss two types of risks in user involvement: the first concerns the reduction of designers’ control over the project, due to the involvement of different people. The second refers to the increase in the project complexity, by reason of the need to manage different objectives and interests, which implies additional efforts in coordination

(Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010; Steen, Manschot, & De Koning, 2011). According to Damodaran (1996), despite the high costs of resourcing and managing the process with user involvement, participation usually brings great rewards.

Forms of user involvement

Many authors discuss the several levels of user involvement (for instance, Arnstein, 1969; Kujala, 2003; Wulz, 1986). The term 'involvement' is general and encompasses various levels of participation, each one representing a relationship between users and service providers at a different level of power (Baggott, 2005). Damodaran (1996) believes that all these levels of participation can be broadly described as three forms of involvement: informative, consultative and participative. Informative involvement occurs when users only provide and receive information; this is the level with the lowest user involvement. Consultative involvement is the intermediate level, at which users are invited to make comments on a predefined service or range of facilities. Finally, participative involvement is the highest level of involvement and occurs when users influence decisions concerning the whole system.

Sanders & Stappers (2008) discuss two approaches of user involvement in design, studied by several authors in the literature: user-centred design and co-design. In user-centred design, users are seen 'as subjects', 'passive objects of study', and the researchers gather knowledge about them through observation and interviews and prepare a report based on this knowledge and the concerning theory. Then designers use this report and their knowledge about technology and creative thinking to generate concepts and so forth. On the other hand, in co-design, users are seen as 'partners' and play an important role in idea generation, knowledge development, and so on. Designers and researchers support users by providing tools to help them to contribute to the design process (Sanders & Stappers, 2008).

Types of users

Users involved in the design process should represent the best possible end-user groups, so that their real needs can be understood by designers (Kujala & Kauppinen, 2004). Olsson et al. (2010) argue that the tendency to implicitly assume that there is only one group of users is common in most discussions about users. Although it appears to refer to a single person or a well-defined group of people, the term 'user' is complex and broad, encompassing many different groups with different and often conflicting values and needs (Bertelsen & Emmitt, 2005; Jensen, 2006).

Olsson et al. (2010) have proposed a model to identify users groups, in which users are divided into these different categories: owners, facilities management and service personnel (operating the building), managers of the organization based in the building, service providers, service receivers, as well as indirect service receivers.

According to Steen, Manschot, & De Koning (2011), selecting the appropriate people to participate, the appropriate roles and stages of participation is critical to the success of the project, since the design process and outcomes can be significantly affected by the choice of methods and ways of working.

Research Method

A comprehensive literature review was carried out to study the state-of-the-art of user involvement in the design process. This review focused on strategies, importance, difficulties and benefits of participatory approaches, mainly in architectural design.

To acquire an in-depth understanding of this approach as applied to healthcare design, the research method used was a case study. This method was useful in investigating ways of including users in the design process as well as difficulties and benefits of doing so. The ongoing PhD research is supposed to have three case studies, and here are presented the preliminary results of the first case study. It was conducted at a Brazilian architecture company specialized in designing healthcare buildings.

Multiple sources of evidence were used to collect data about the user inclusion strategies of the architecture company, as proposed by (Yin, 1994). Table 1 shows the multiple sources of evidence used to collect data, which were interviews, document analysis and archival records. Interviews were recorded and transcribed and then analyzed for content and themes.

Table 1: Data collected through multiple sources of evidence.

Sources of Evidence	Data Collected
3 open-ended interviews with the general director of the architecture company	Standard operational procedures of the architecture company; techniques of user involvement; explanation about an example of a healthcare refurbishment that had involved users at early stages of its design process.
Focused interview with the general director and the design director of the architecture company.	Further clarification of the design process and user involvement strategies employed by the office.
Document analysis (texts produced for internal distribution, publications and educational materials with examples of designs).	Complementary data about the design process.
Archival records (general director's personal records).	General director's experience with healthcare design and relationship with clients.

As proposed by Creswell(2012) for qualitative researches, data analysis followed these steps: preparing and organizing data collected for analysis; reducing data into themes and, finally, representing the data in a discussion and figures.

Results

Located in the city of São Paulo, Brazil, the architecture company studied is skilled in designing healthcare and educational buildings and consulting. It has designed several buildings in many countries over 50 years. The architecture company staff is

composed of a general director, a design director, a design coordinator and a multidisciplinary design team comprising architects, economists, hospital consultants, ecologists, epidemiologists, biostatisticians, a market analyst, a physician, and other professionals.

The architecture company considers that people that work at a healthcare institution should be involved in its design process because they know how the care delivery activities are performed in the building. Other users, such as patients and visitors, are not included, because the architecture company believes that they are not able to contribute relevant data to the design process with respect to efficiency in delivering healthcare.

The process begins by defining the representatives for both the design group and the users group. The representatives are responsible for collecting information from their respective group and discussing it with the representatives of the other group, and making decisions on behalf of the users. Moreover, they are responsible for communicating the decisions to their corresponding groups (Fig. 1).

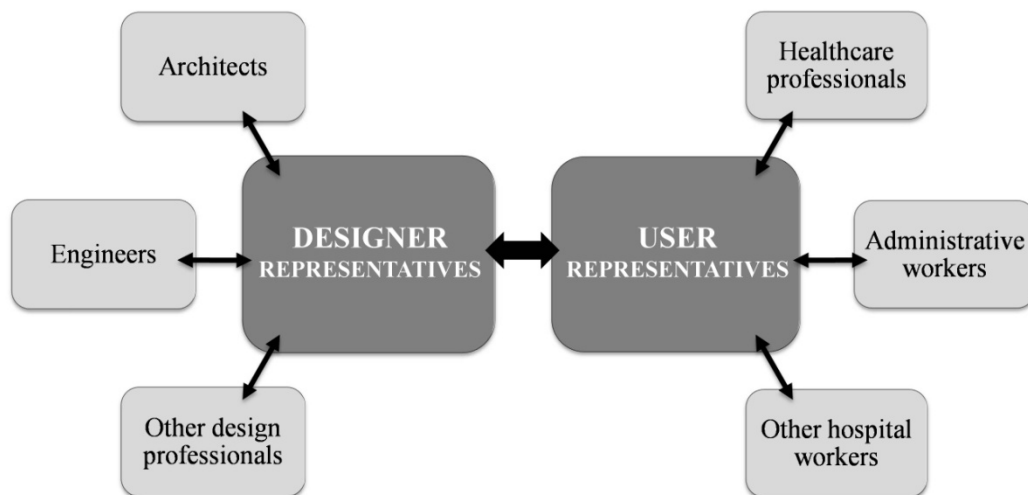


Fig. 1. Representatives for the designer and user groups.

Although only the users' representatives take part in the design meetings, all users are given a questionnaire about their requirements so as to have a voice in the process. Then their representatives collect all answers and discuss them with the designers' representatives. The case study showed that it is important to prepare users to participate in the process. The architecture company usually organizes lectures to introduce users to the terminology and concepts utilized in the design process, and also to explain to them which type of information is relevant to the designers.

Once prepared, users have to be encouraged to participate in the design of the service activities. At this stage of the design process, the most important tool is the operational program, which describes the operation of the building, its units, activities and flows (Caixeta & Fabricio, 2012). The users' experience is especially useful in defining the operational program. Based on the operational program, designers can later develop the physical program, which is a representation used by designers. Users are not familiar to design language, so the operational program is

represented graphically as ‘bubble diagrams’ (Fig. 2 and Fig. 3). In bubble diagrams, a bubble represents each activity or unit, and arrows connecting the bubbles represent flows, and there are no dimensions or rooms. Due to their simple representation, these diagrams encourage users to participate in the process and help them to understand the design (Caixeta & Fabricio, 2012). The designers in this study reported that there was more participation as a result of using this uncomplicated representation than when they used sophisticated designs and images at first presentation.

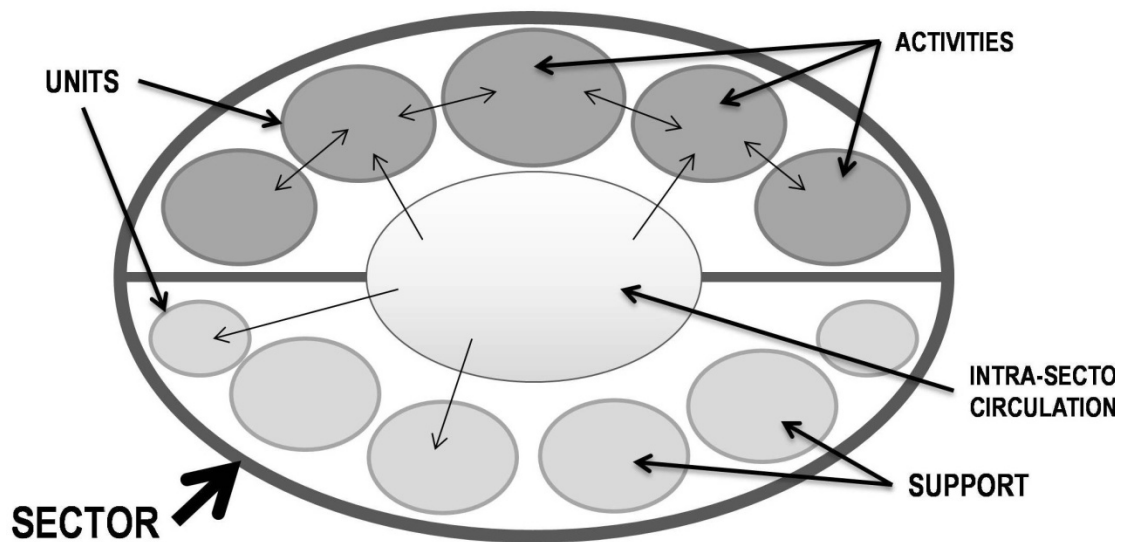


Fig. 2. Example of a bubble diagram of the internal organization of a sector.
Source: General Director's Lecture Notes (2008).

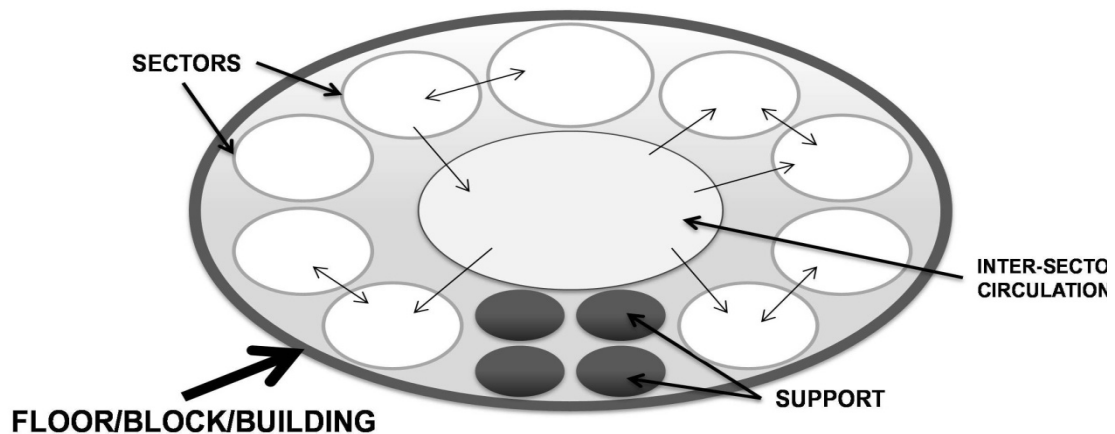


Fig. 3. Example of a bubble diagram of the sector organization in the floor/block/building. Source: General Director's Lecture Notes (2008).

Another strategy employed to promote user participation with regard to the refurbishment design of the Clinical Hospital in Brazil was to designate a room inside the hospital, which was a physical space for meetings and discussions about the hospital refurbishment design. This was a way to strengthen relationships between designers and users.

Due to the large number of users, the designers also highlighted the importance of having an effective coordinator – among the user representatives – to sort out conflicting needs. Moreover, designers mentioned that users regularly come up with new requirements and ideas throughout the process, so the users' coordinator plays an important role in establishing a fixed period of time for gathering requirements and suggestions to ensure that deadlines are met.

Discussion

Several authors have pointed out the importance of early user involvement in the design process (Damodaran, 1996; Jensen, 2011; Kujala, 2003). In agreement with the literature review, the preliminary results of the case study point to the important role played by users in laying out flows and activities for the service design of healthcare buildings. *Service design* can take advantage of users' experience in order to fit the building to the best way of carrying out healthcare activities. On the other hand, *building design* makes use of a language that users are not familiar with and demands specific knowledge. In this case study, the architecture company advocates a lower level of participation to allow the designers more control over the decision-making process. Hence, the case study suggests that the most appropriate form of user involvement in healthcare design is “participative” at the service design stage and “consultative” or even “informative” at the building design stage, as defined by Damodaran (1996).

In spite of the possibility of user involvement bringing variable and conflicting requirements to the project, the studies of Kujala & Kauppinen(2004) showed that in most cases it is possible to identify a core set of common requirements, because user needs do not vary much. Therefore, a broader set of users' needs can be met during the design process. However, the authors remark that it is important to identify and take additional and conflicting requirements into account at the early stages of the process.

Both the literature and the case study showed the importance of using tools to promote user involvement, because most users are not prepared to participate in the design process in a successful way so as to produce the intended results. According to Steen et al. (2007), it is important to facilitate and organize multi-disciplinary teamwork, conversations and iterations so that users can have a real voice and designers can find inspiration with them. Otherwise, user involvement does not generate value. The case study showed that efforts made in the way of simplifying the design representation, in conjunction with previous training of the users, facilitate user involvement in the design process. The architecture company employed bubble diagrams as a tool to simplify the design representation, since users felt more at ease when they draw bubbles and arrows to represent their activities and flows.

In spite of its benefits, user participation can bring some risks and increase the costs of the process. Involving more people in the project implies increased complexity and requires additional coordination efforts (Hoyer, Chandy, Dorotic, Krafft, & Singh, 2010; Steen et al., 2011). In the case study presented here, besides the user representative group, there is a users' coordinator, whose crucial role is to sort out conflicting requirements and to avoid delays in users' activities during the process.

Conclusion

This paper has addressed the preliminary findings of a postgraduate research about the promotion of user involvement in the design of healthcare. A succinct literature review on the topic of user involvement in design processes was presented as well as the outcomes of the first case study, conducted at a Brazilian architecture company specialized in designing healthcare buildings. It has discussed the importance of involving users in the definition of flows and activities of service design, so that designers can understand users' real needs and the ways they perform care activities. Furthermore, the preliminary results indicate the importance of training users for participation and of simplifying the design representation, by means of bubble diagrams, in order to facilitate user involvement in the design process as they are not usually familiar with design representations.

Other case studies are planned for this PhD research in order to further investigate the process of user involvement in healthcare design, and also to study better ways of participation in this kind of design.

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Real estate asset management and its relationship to corporate strategic management in the Scottish university sector

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Abstract

This paper discusses the proposed research approach and initial findings from research exploring real estate asset management and its relationship to corporate strategic management in the Scottish university sector. It contains a continuation of a review of literature, covering both government policy documentation in relation to university estates management and corporate real estate management. The latter emphasises the need for real estate asset management to reflect organisational strategic management as a means of maximising the utility of the real estate resource. In considering the most appropriate research approach, the researcher's insider position within the university sector is highlighted. This is considered to offer advantages in relation to the development of existing knowledge. It is argued that the research question lends itself to an interpretivist approach with the intention of obtaining mostly qualitative data. The writer had not developed an overall substantive theory prior to the commencement of the primary research and is adopting a grounded theory approach to the analysis of research findings. As an initial exercise in 'grounding theory' research has been undertaken in the writer's own institution, Glasgow Caledonian University. The findings have emphasised that the link between real estate strategy and organisational strategy has become more apparent as the latter has developed. It is also apparent that major capital projects have helped to increase the focus on the linkages. Research at the writer's own institution has acted in some ways as a pilot case study in order to inform the future direction of research amongst the remainder of the research population of Scottish universities. This will then allow for the development of further theory through the study of additional institutions until saturation of data is obtained. It is envisaged that substantive theory will be developed from the research population in Scotland which may then allow for the consideration of its applicability to universities across the UK and for further research to be undertaken.

Keywords

Real estate asset management; Higher Education strategic management; insider research; grounded theory.

1. Introduction

This paper discusses the research approach and the analysis of initial data from a pilot case study relating to real estate asset management and its relationship to corporate strategic management in the Scottish university sector.

A critical review of government policy on estate management in the UK higher education sector has been undertaken. The review of policy documentation produced by higher education funding councils examined changes in policy and emphasis over recent years. The review was undertaken having regard to theoretical principles of corporate estate management established in general literature. The researcher's own reflections on policy had regard to past work experiences and recent experiences as a university stakeholder.

2. The Research Topic

The aim of the research is to explore the extent to which real estate asset management within the Scottish university sector relates to, and is integrated with, the overall strategic management of the institutions. The objectives for the study are to determine: (1) the extent to which the principles laid down in general corporate real estate asset management literature are followed; (2) the influences which have driven the development of strategy at the institutional level; (3) the extent to which institutional real estate strategy is reactive or genuinely proactive; and (4) good practice which may be usefully employed across the sector.

3. Literature Review

3.1 Effectiveness of corporate real estate assets

It has long been recognised by many writers that operational property assets can contribute significantly to the overall effectiveness of an organisation (Edwards & Ellison, 2004, Haynes & Nunnington, 2010, Jones & White, 2008, Nourse & Roulac, 1993). For most organisations property is the second highest business cost after wages (Royal Institution of Chartered Surveyors, 2002) and it therefore requires to be managed effectively. This is especially important given the changing nature of education institutions' operating environment and changes to teaching methods and course delivery. Its importance is only emphasised in the present economic climate, where the funding for Scottish universities remains challenging.

It had perhaps been considered by many, without any actual evidence, that the private sector was more effective in this activity than the public sector. However, evidence obtained by Gibson (1991) concluded that this was not in fact the case. It was not possible to isolate specific groups as being either good or bad at operating its operational property and that effectiveness was more dependent upon the overall process followed than on specific techniques employed.

Belcher (1997) charts the introduction of performance indicators for the purpose of resource allocation within higher education back to 1985. This original focus had been broadened to encompass the quantum and quality of the teaching and research processes. The original application of performance indicators to embrace estate management could have been criticised at the time due to their primary aim being to inform the decision of national funding institutions rather than those of institutional managers. In considering the example of a recently developed building at the University of Portsmouth, Belcher proposed to redress the deficiency through the provision of a detailed and hierarchical system of performance indicators. These were designed to sustain the teaching and research processes.

3.2 Public sector asset management guidelines

The public sector asset management guidelines produced for the Royal Institution of Chartered Surveyors (RICS) in 2008 clearly identify the need to link an organisation's real estate assets to its core business objectives. While not specifically aimed at the university sector, the guidelines do, nevertheless provide a platform from which the research proposal can develop. They define asset management as:

"The activity that ensures that the land and buildings asset base of an organization is optimally structured in the best corporate interest of the organisation concerned. It seeks to align the asset base with the organisation's corporate goals and objectives. It requires business skills as well as property skills although only an overall knowledge of property matters is required. However, property input within the overall process is imperative." (Jones and White, 2008).

This had previously been highlighted by the Higher Education Funding Council for England (HEFCE) in its *Estate strategies: A guide to good practice* in January 2000, emphasising that an estate strategy needs to be part of an institution's corporate strategy, supporting the achievement of its aims and objectives. The Scottish Further and Higher Education Funding Council (SFC) highlights the point further in its *Estate strategy guidance* (Scottish Funding Council, 2007a, 2007b), by considering it as one of the ways institutions can become highly effective world class organisations.

3.3 The link to corporate strategy

It has generally been recognised by writers in corporate real estate (for example, Edwards and Ellison, 2004, Haynes and Nunnington, 2010) that corporate real estate professionals need to be able to evaluate, interpret and respond to an organisation's corporate strategy. The definition of strategy is clearly crucial here and Johnson *et al* (2008) provide a relevant statement:

"Strategy is the direction and scope of an organisation over the long term, which achieves advantage in a changing environment through its configuration of resources and competences with the aim of fulfilling stakeholder expectations."

Haynes and Nunnington (2010) emphasise the importance of understanding the strategic position of an organisation. This involves undertaking a strategic analysis of an organisation in terms of its external environment, internal resources and competencies, and the expectations and influences of stakeholders. The actual real estate resources used by an organisation can directly impact upon the corporate strategy, and ultimately the organisation's performance. A corporate business strategy addresses such crucial elements as customers, employees and processors and Roulac (2001) emphasises that these elements are profoundly affected by the environments in which the company does business; the environments in which the enterprise interacts with customers, houses its people and supports its processors. These are elements of corporate property/real estate strategy.

3.4 Corporate real estate at the strategic level

In order to ensure that these linkages are made, there is a requirement for corporate real estate to be discussed and developed at a strategic level (Edwards and Ellison, 2004, Haynes and Nunnington, 2010, Then, 1997). At the development stage the real estate manager may offer the potential of not only developing an estates strategy to support the overall corporate strategy, but can act to actually inform corporate strategy development. The complexities of corporate strategy may require multiple rather than a single real estate strategy and require to be kept under continual review (Nourse & Roulac, 1993). This is also reflected in estates guidance for Scottish universities (Scottish Funding Council, 2007a) and is an area for investigation for the research.

If a corporate real estate strategy is integrated within overall corporate strategy, then it can provide a competitive advantage to the organisation (Edwards and Ellison, 2004, Haynes and Nunnington, 2010). In evaluating how organisations can use their corporate real estate to obtain competitive advantage, it is considered that an integrated strategic model is required (Singer *et al.*, 2007). This is considered by the writer to be of relevance to university real estate strategy development within both a more competitive national and international environment. It is considered relevant to seek to explore the extent to which it is being adopted by Scottish universities.

Consideration needs to be taken of the organisational culture of Scottish universities. When considering a real estate strategy for an organisation it is necessary to identify and understand the beliefs and values of the organisation and the 'cultural web' is referred to by Johnson *et al.* (2008). These aspects will be explored as an integral part of the research.

While private sector organisations focus upon profit maximisation for their shareholders, there is still a requirement for public sector organisations to prove they are utilising resources, including real estate, efficiently. Given this, there has been increasing emphasis placed in many organisations upon non-core activities, such as real estate, demonstrating how it can add value to an organisation. The researcher considers that this is perhaps easier than it sounds. Lindholm *et al* (2006) highlight that making the linkages between the corporate strategy and real estate strategy requires an integrated measurement system. This is also a concept that requires to be investigated.

3.5 Measurement of corporate real estate impact

Understanding the organisation's business strategy is the starting point for the creation of a supportive real estate strategy. Once the real estate strategy that most aligns to the business strategy is decided upon, consideration can be given to the implementation and measurement of the strategy.

In an attempt to raise the profile of real estate, Scheffer *et al* (2006) propose a measurement tool that enables corporate real estate professionals to specifically identify which elements of corporate real estate enhance corporate strategy. The measurement tool proposed integrated frameworks from those originally published by Nourse & Roulac (1993) and De Jonge (1996).

The alignment of corporate real estate asset management strategy to corporate strategy with the aim of adding value and enhancing operational performance has

been the focus of much research. Recent research in corporate property has especially focussed upon the workplace design and occupier productivity and such is the complexity of the subject that it requires innovative methodological research design (Haynes, 2009). Despite the topicality of this subject, it is not the purpose of the research to cover it. Much of the research has focussed on the traditional office environment and it is considered that the relative uniqueness of university accommodation would not lend itself to such comparisons.

4. Considerations for the Research Approach

4.1 The researcher as an insider

Careful consideration was given to the position of the researcher in relation to the research topic and the subjects of the research proposal having regard to the understanding of insider researchers as native to the setting (Brannick and Coghlan, 2007).

The proposed research setting will encompass university estates departments and senior personnel with relevant strategic estates input. While not a member of a university estates team, nor a member of a university executive, the researcher has nevertheless achieved a significant insider position with a rich and complex knowledge of the system to be investigated. Careful consideration of this position was needed, aligning with the belief of Brannick and Coghlan (2007) that through a process of reflexive awareness tacit knowledge that has been deeply segmented because of socialization in an organisational system should be capable of being articulated and then reframed as theoretical knowledge. However, the researcher recognises that he is not a complete member of the community and that this will influence the ongoing choice of research approach to be adopted.

4.2 Ontological and Epistemological Positioning

A constructivist ontology has been identified in respect of the research, adopting an approach of 'social constructivism' (Grix, 2004). It also follows the form identified by Dainty (2008) as being dominant in the construction management field, aiming to understand the social structure and interactions between those working within, and affected by, the built environment, in this case university estates. The research design also needs to be relevant to the identified empirical position following the most widely adopted emphasis within the built environment community (Griffiths, 2004). It is considered that an interpretivist approach to the research proposal would most closely align with the objectives of the research. It is the understanding of human behaviour which is considered important, even if this may provide competing or conflicting frameworks of understanding (Griffiths, 2004).

4.3 Research Approach

A qualitative approach is being adopted utilising what Robson (2002) refers to as a 'flexible design'. He also emphasises how research designs making use primarily of qualitative data can also include some element of quantitative data collection. This would accord with the research, where it is anticipated that a small element of quantitative data will be collected across the research population of Scottish universities. While writers such as Bryman and Bell (2003, cited by Dainty, 2008) have criticised multi-paradigm research, it is considered that in this situation the (limited) scope of quantitative data requirements make consideration of a (limited)

mixed methodology suitable (Amaratunga *et al*, 2002). A ‘flexible design’ should allow for many aspects of design to be clarified during the process of the study (Robson, 2002) and for a pilot case study to undertaken.

Such quantitative data is likely to include details such as university estate accommodation data, categorised in relation to industry standards (Scottish Funding Council, 2007a). This will allow for comparisons to be made within organisational classifications and for the subsequent qualitative data to be analysed within such classifications. Jarvis (1999) in considering research by practitioner-researchers, emphasises that an integral source of data is that obtained from a variety of documentary sources. Various documents may require to be obtained from universities in order to supplement the generalised information contained within government publications and to act as a means of triangulating data obtained via interviews. The *Estate Strategy Guidance* (Scottish Funding Council, 2007a) considers that the type and size of institution will determine the type of strategy that will be required and categorises institutions in the following table:

Type of Institution	Type of estate strategy
Single campus – small / medium college	Estate strategy typically covering 10 years
Multi-site campus (estate building value below £130 million) – small / medium university	As above
Multi-site campus (estate building value above £130 million) – large university	Masterplan typically covering 10-20 years with an estate strategy updated periodically within that timeframe

The Scottish Funding Council (2009) has more recently published the following categorisation of Scottish HE institutions:

Category	Institution
Ancient	University of Aberdeen University of Edinburgh University of Glasgow University of St Andrews
Pre-1992	University of Dundee Heriot-Watt University Stirling University University of Strathclyde
Post-1992	University of Abertay Dundee Glasgow Caledonian University Edinburgh Napier University Queen Margaret University Edinburgh Robert Gordon University University of the West of Scotland
Small Specialist Institutions	Edinburgh College of Art Glasgow School of Art Royal Scottish Academy of Music and Drama

It is proposed that data be obtained from universities (excluding the SSIs) covering all categories from both tables.

4.4 Anticipated research outputs

The view of Robson (2002) is that a researcher should want to say something helpful; seeking not merely to understand something, but also trying to change it. This could certainly be said to be the case in respect of the research. It is envisaged that substantive theory, as identified by Glaser and Strauss (1967), will be produced with application to university real estate management and that new theory is built upon existing theory in order to make improvements (Whetten, 1989, cited by Hunter and Kelly, 2008). While it is not the specific intention to produce an overall theory, it can be anticipated that useful insights into approaches and practice will be obtained that may be capable of being used by other organisations within the research population and across UK universities. This would allow for the production of both academic research and research that was of potential interest and use to practitioners in the field (Aram & Salipante, 2003, Keleman & Bansal, 2002).

4.5 Research Design

It is the intention to pursue a grounded theory approach to the analysis of data for the research. This should enable theory to be developed from data and not from speculation or preconceived ideas (Hunter *et al*, 2005). It is the intention to build a theory, as opposed to testing a theory and to offer an explanation of phenomena rather than a mere set of findings (Strauss and Corbin, 1998). The tacit knowledge of the researcher needs to be recognised in terms of the potential benefits it may bring to the emergence of theory through interpretation of data (Lincoln and Guba, 1985).

Within a traditional grounded theory approach, there have been conflicting views on the role and timing of the literature review (Hunter and Kelly, 2008). The purer approach suggested by Glaser (1992) involves literature review after data collection, so is not applicable here, while Strauss and Corbin (1998) emphasise the completion of a literature review in order to identify an overall theoretical statement to be tested. Smith (1997) highlights a general literature review being undertaken in order to obtain a feel for the issues and to identify gaps to be filled using grounded theory. The review of corporate real estate asset management (CREAM) has allowed for questions to be identified and for semi structured interviews to be undertaken with a view to satisfying the objectives of the research. It is considered that there is a mix of both deduction and induction in relation to the questions (Patton, 2002) whereby confirmations are required in relation to CREAM principles thus satisfying the first objective, plus a desire to obtain rich descriptions from interviewees in order to satisfy other objectives. This will offer potential for a creative approach with the level of detail defined by the area for study and allowing for theories to evolve from the data itself, thus producing a grounded theory.

It is considered that offering research participant anonymity through the adoption of a grounded theory approach could have advantages in the agreement of individuals and organisations to participate, in contrast to that of a more traditional case study approach where cases are usually identified (Yin, 2009). Under traditional grounded theory, data collection continues until the point of data saturation, although the definition of 'saturation' is varied, however, and Patton (2002)

believes that researchers should use their own judgement based upon a reasonable coverage of the issues.

5. Pilot Case Study

For the first stage of the research, a pilot case study was undertaken in the researcher's own organisation, enabling initial theory to emerge and allowing for a second literature review to be potentially undertaken and for it to be woven into the subsequent emerging theory.

Allowing for the potential of greater bias due to the particular 'insider' position, it was however, recognised that it is not possible to be completely free from bias (Strauss and Corbin, 1998) and the advantages of access to data and personnel within the researcher's own organisation were considered to outweigh any perceived disadvantages. In considering traditional case study approaches, Yin (2009) highlights how an unusually congenial and accessible site which is geographically convenient can make an appropriate pilot case.

Initial scene-setting interviews were held with key personnel and agreement gained for the pursuance of the pilot study in depth. This included members of the university executive who either had direct estates responsibility or a related interest, senior staff responsible for overall university strategy and the Head of Estates. A range of personnel was selected as it was considered that they would have different scopes of consideration and by combining these, a fuller picture could be obtained (Barrett and Barrett, 2003). This resulted in access to useful documents ahead of official publication while interviewees were also helpful in suggesting the relevance of others to be interviewed as part of the pilot study, thus utilising a snowballing technique (Green *et al.*, 2010). The pilot can be considered an exploratory case study both in terms of the research subject and the research approach being pursued.

The main interviews were aimed at collecting perceptual data from sixteen questions which were formulated on the basis of issues highlighted in both general literature relating to corporate real estate asset management and funding council guidance. Half of the questions were considered to be relatively open, encouraging expansive responses. The other questions, which sought clarification on practice recommendations, nevertheless, still encouraged opinions to be expressed. Tape recordings were manually transcribed shortly after each interview and this helped with

recollection of paralinguistic indications about interviewee's meanings. The raw data was then filed on computer to aid retrieval. The analysis involved the reduction of data from the individual transcripts, involving focussing, simplifying and transforming it into a database of grouped information.

6. Pilot Case Study Findings and Discussion

The following section will discuss initial findings from the pilot case study. They are presented by reference to the interview questions, most of which were answered by all of the recipients. A two stage process to coding was undertaken. The initial categories had been identified through the literature and hence encompassed a deductive response. Following transcription, the second phase involved inductive affirmation, which lead to identification of 'core' categories.

6.1 Strategy integration to achieve competitive advantage

Emphasis was placed upon the estate being a very important strand in the corporate strategy. Major capital projects were particularly highlighted as focussing attention upon the importance of the estate within overall corporate planning, with one interviewee referring to them as “game changing”. The importance of having an attractive estate was linked to both student recruitment and student retention. Evidence suggested an increase in applications occurred following completion of a new learning centre, the most recent major capital project. It was increasingly being realised that attractive research space was important in attracting the right research and academic staff.

6.2 University beliefs and values

It was remarked upon by many interviewees that the beliefs and values do contribute to the development of the university’s real estate strategy. The relative compactness of the campus, while historical, was considered to provide a strong sense of community in tune with the university ethos and values. The current Master Plan sought to encapsulate this while references to the existing campus included its “inclusiveness” and “permeability” as “a visible expression of the university’s own value set”.

6.3 Estates strategy group

An estates committee has only been established for three years and was considered necessary by the University Secretary in order to provide focus in the area. There was “a very conscious wish to get the people with core business strategic portfolios in the same room as the estates people”. It was also considered important that the committee was chaired by an experienced University Governor, whose background was in the construction sector.

6.4 Transparency and communication

There were conflicting responses around these issues. While it was generally considered that the recent Master Plan exercise has been conducted in an open, inclusive and transparent way, there were some concerns over the timing of communications regarding recent capital projects due to parallel re-profiling and re-structuring at the University and perceived sensitivities at the time. It was commented that the effective ‘ring fencing’ of finance for capital projects was perhaps not generally understood across the University. There was, however, recognition of the importance of strong communication in the future.

6.5 Decision makers

There was general agreement that university decision makers were becoming more literate around the potential real estate implications of various decisions made. There was uncertainty as to why this may be so, with the relative compactness of the single-campus being cited as a possible reason. Reference was made to people being quite spatially aware.

6.6 Estates liaison

A range of effective contact between Head of Estates and the Estates Executive Lead, both formal and informal was highlighted. A specific connection was made

with the previous point highlighting the increasing level of estates literacy, whereby the Head of Estates was regarded as accessible and responsive to estate users' needs.

6.7 World class organisation

"I think you can't underestimate place" was a strong statement made by one interviewee. Specific reference was again made to the university benefitting from permeability, an openness, that lead to it being very accessible and perceived that way. Anecdotally, it is considered that the attractiveness of the campus does act as a selling point in student recruitment. In respect of international student recruitment, while decisions will have been made in relation to their preferred course, the attractiveness of the campus will be communicated back home once they are studying at the university. The Learning Centre, developed in 2006 as the last major project, still impresses and that message gets relayed back home.

6.8 Refinement of estates strategy

There was no confirmation that the estates strategy has been refined annually. Highlighting the production of the Master Plan, one interviewee remarked: "...so you weren't going to refresh your estates strategy until you'd done your master plan." Admittance that perhaps estates strategy should have been refreshed after the year "...just to check it still makes sense."

6.9 Estates personnel

The (small) scale of the estate has contributed to identification of relevant personnel requirements and the need not to have an Estates Director. It was not considered that the existing estate would keep somebody at a very senior level sufficiently engaged long-term. Although there may be a fixed-term need for certain expertise to help with strategizing and integration of major project work.

6.10 Estates Director and 'estates champion'

All respondents except one expressly considered that the University Secretary and Vice Principal (Governance) (USVPG) represented a strong estates champion.

6.11 Learning and teaching trends

Reference was made to the idea of developing a 'smart' campus, seeking to integrate estates and IT facilities. "But it's the overall experience, the GCU experience, both physically and virtually, and perhaps critically the blend of the two, that gives the opportunity for us to really stand out from the crowd."

6.12 Sustainability

It was emphasised that sustainability was one of the two cross-cutting themes in the updated University strategy, along with internationalisation. Reference was made to the Executive Board absolutely signing up to it and policies flowing from it such as the carbon management strategy and creation of a Sustainability Steering Group chaired by USVPG.

7. Pilot Study Outcomes and Future Work

The pilot case study was anticipated to cover both substantive and methodological issues and to help to refine subsequent data collection plans, both in terms of the content of the data and in relation to procedures.

It is considered that the pilot case study has generated an anticipated level of useful data, which can be analysed as part of a concurrent process of grounded theory analysis. The main findings and ‘core’ categories identified are that the link between real estate strategy and organisational strategy has become more apparent as the latter has developed. It is also clear that major capital projects have helped to increase the focus upon the linkages.

The participants in the pilot study did talk freely and provided comprehensive and useful data. Despite the relatively large number of questions, it was not felt that this was ‘forcing’ data, but consideration is being given to the refinement of questioning for subsequent cases, also having regard to the differing ‘insider’ position of the researcher. This will have relevance to ordering of the interviews between the various personnel at subsequent universities and to the consideration of the various sources of documentary evidence and its triangulation within the overall research analysis.

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Exploring the Impact of Transparency on Ethics in the Property Profession

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Abstract

Transparency can be described in the simplest form as whereby the rules by which we are subjected too are made obvious. The methodology behind these enforced rules is made clear to all. The degree of transparency can be interpreted by the information which is made available to those outside the process. When examined in the context of economic sciences, it is often referred to as information equivalency. The opposite of transparency, being opacity, therefore been described as information asymmetry of market participants. The researcher has chosen to evaluate the principle concept of transparency in an economic context with a specific emphasis on the Irish Commercial Property Market. This paper examines transparency and the inherit ethical issues that may occur in satisfying its requirements.

Keywords

Transparency, ethics, property, behaviour, transactions, negotiations.

Introduction

The researcher has chosen to evaluate the principle concept of transparency in an economic context with a specific emphasis on the Irish Commercial Property Market. Integral to the property markets operation are the transactions which occur. This paper examines transparency inherit ethical issues that may occur in satisfying its requirements. For compliance with transparency provisions, could ethical interpretations be manipulated in favour of commercial instincts. Thus sacrificing ethic in what is perceived to be in the greater commercial interest of the client.

Understanding Transparency

In understanding the ethical dilemma which transparency may create, it is important to understand how the situation may manifest. Therefore we begin by examining what is transparency and how does it apply to the commercial property market.

The dictionary describes it in its simplest form as an essential condition for those operating in a market which ensures the rules at which they are subject to are made obvious. It states for transparency to be present, the methodology behind the rules that are enforced are required to be made clear to all participants (Oxford 1991,2007 & 2010) (Chanler & Munday 2011). Some define transparency as the degree at which information is made available to those outside a process. They believe this information is needed in making their own decisions, or have the ability to analyse decisions made by others (Seidmen 2011). Transparency can be used to judge

accuracy. Transparency is examined in the context of economic sciences, it is often referred to as information equivalency. The opposite of transparency, being opacity, can therefore be described as “information asymmetry of market participants” (Pitsche 2005). Those involved are failing to get a symmetrical view on the market.

Transparency in Society

It is taught that when society has the information, there is an improvement in governance. To have transparency in society, support from all section of the community is required. This is the government, professionals and the general public (Ball 2009). Transparency can be brought about by the public demand for information. Certain issues enter the realm of the public conscience. Examples would be problems in the health and financial sectors. These issues have the ability to generate demand for more information. This demand therefore facilitates the growth of transparency as society requires the information to be made public (Fox 2007).

In seeking transparency it is important to acknowledge that certain restriction may be required to maintain market confidence. Some commentators argue certain discretionary powers are required, as the full disclosure may not always be in the best interest of the market. They refer to it as the difference between the need to know information and the need to understand (Demertzis 2007). It could be perceived that it is not in the best interest of the market to supply the general public with information they do not understand. Some blame the heterogeneity of commercial property that makes it difficult to those who do not work in the profession to interpret the information (Millington 1994).

Transparency and the Commercial Property Market

The ongoing turmoil in the global financial economic and real estate markets has influenced market behaviour. The primary focus is on survival rather than ensuing market advancement (Jones Lang LaSalle 2010). However, the fundamentals of what constitutes a transparency in commercial property markets have not changed. The price of property is not determined in the same as other commodities. Pricing information is not always freely available. Therefore property by its nature can be complex when it comes to decision making. Participants in the process will often have to make decisions with an element of uncertainty (Dunse 2003)

Property professional analyse the relevant market information. They determine the level of demand and supply for a property together with examining comparable evidence of recent transactions for similar properties. The comparable evidence will be analysed on how it compares to this particular property (Millington 1994). Integral to the process is the ability to compile market evidence. This market evidence is crucial. Without it, a valuer’s work can not be substantiated. This impacts the credibility of their findings (Baun & Crosby 1995). Traditionally property transaction detail is available through a network of professional contacts. For an establish professional it can work efficiently as they have developed a number of sources with whom they trade information. However this can often be hampered by client insistence on confidentiality or where transactions are becoming less frequent (Wyatt 1996).

The shortcoming in comparable evidence has been recognised. It has been shown that comparable evidence can be significantly impacted by the existence of items

such as side letters and confidentiality agreements. They give rise to situation whereby the headline rent being expressed on the lease may not be the true market rent being paid by the occupier. Problems occur as this information is used as benchmarks for similar properties. They are not a true reflection of the rent being paid, however because of the lack of transparency they can be used to manipulate the market in the interest of one party (Department of Justice 2010). The market produces prices and the valuer analysis then. It is assumed that they act independently (Baur 2000).

Where there is a lack of available reliable data, the property profession is reliant on their subjective judgment. The over reliance on non quantifiable data can have a negative impact on the efficiency of the market (Diaz 2002). Valuation methods are reliant on the collection and analysis of data. This requires knowledge of comparable evidence to produce a valuation (Millington 1994). The process is dependant on the information being supplied being accurate to ensure the valuations are correct. A number of factors can impact the availability of this data, from legislative restriction on the publication (SCS 2011), to some market stakeholders preferring not to release details on their property transactions. Even when data is available, it is sometimes incomplete, therefore lacking suitability of purpose (RICS 1994).

Market conditions have the ability to impact subjective judgement. The process of gathering evidence can be influenced by the human behaviour whereby one can seek to find confirming as opposed to disconfirming evidence (Baron 1985). The valuer may seek to use property data that they believe will be beneficial to their client. A valuer may not be conscious that they are applying bias. It has been shown that knowledge which is learned through experience can contain certain groups of procedural knowledge that is applied to the process. The valuer has established standardized approach to their work. The pending potential value may already have been discussed. This could influence their judgement thus creating a bias valuation (Gallimore 1997).

The difficulty that the lack of transparency has on a commercial property market is that without full access to information on all transactions taking place, the property professional can be subjected to undue influence. Clients have the ability to incentivise the valuer as to the required outcome of the valuation. Valuations are a service offered to clients. In many circumstances the client is acting for a third party (a bank or lending institution). Property professionals compete with each other for this work. It can be difficult to show that the process is fully independent because of their active involvement in the market. They could be shown to have a vested interest in the outcome (Levy & Schuck 2005)

The lack of available information in a commercial market has the ability to be distorted. Inducements are frequently used in the Irish commercial market. Inducements are usually agreed during the negotiations stage. These inducements can take many forms, examples being (Sirr 2007):

- Rent free periods: The tenant is offered a rent free period while they are fitting out the unit.
- Stepped Rent: It may be agreed that the rent will be stepped over the rental period.
- Premiums – In a buoyant market a tenant may have to pay a premium sum to a landlord to gain occupation. In recessionary times existing tenants wishing

to assign a lease may offer potential occupiers a premium sum to take possession of the lease. Landlords may offer a premium sum as form of inducement a prospective tenant to occupy a unit

- Contribution from Landlord: To encourage a tenant to agree to lease a premises the landlord may make a financial contribution towards a cost of a tenants fit out.
- Acquiring a new tenants existing lease: The tenant may be tied into an existing lease which has a period remaining. The landlord will acquire the old lease therefore allowing the tenant to move to the landlord's premises

Some stakeholders in the commercial property market are opposed to full transparency. They maintain certain discretionary powers are required as the full disclosure may not always be in the best interest of the market (Demertzis 2007). Some (Nugent 2007) argue that not all information pertaining to property transactions should be disclosed.

Ethical behaviour

Negotiations are recognised as a key skill of the property professional. Property negotiations can be said to be part of the problem solving domain. By comparison, problem solving requires both knowledge of the problem to be solved and the methods to be employed in reaching that solution. Property negotiations function on the same basis (Black 1996).

An intrinsic part of activity occurring within the property market is the process of negotiations. The property professional will provide the service as intermediary to bring about a successful conclusion to the process. It is with the performance of this function where they can often be open to ethical criticism (Alirat 2010)

In the context of behavioural patterns, negotiators have been found to introduce heuristics. This can be defined as a shortcut used by decision making process as a mean of processing the information quicker (Black 1996). Market knowledge is integral to the decision making process (Adair 1998). Purchaser can inadvertently overpay for property in circumstances where they do not possess the relevant information (Dotzour 1998). The introduction of asking price in to the negotiations can have implications. They have the ability to bias the end result of the process. In comparison to similar properties the asking price may differ substantially to what is been achieved on the open market. (Black 1996)

The market has evolved in terms of knowledge over the last number of years. With the availability of sources, it is now possible for the surveyors client to be well acquainted with how the market is functioning (Matzdorf 2000). Is it possible that this over familiarity results in further difficulties for the surveyor. Their client perceives the sharing of knowledge with the negotiating party as weakening their position. Therefore exhorting undue pressure subsequently impacting ethical behaviour (Alirat 2010).

The financial benefits may be found to out weigh out ethical considerations on weather the data introduced in negotiations is factually accurate. Studies have found that circumstance can arise whereby the negotiator is putting more weight on an asking price which is incongruous then on the relevant market information. The existence of performance based reward systems has the ability to influence their

behaviour (Black 1996). The threat to the profession is that, whereby the agent erroneously believes they are acting in the best interest of their client, they may be inadvertently damaging their profession. Demand for a profession is said to exist based on public demand. Therefore part of the survival of a profession is that they maintain public confidence (Alirat 2010)

The clients however may not be alone on attitude to such behaviour. It may also be identified within their own firm. It is often claimed that the flow of information out of an organisation can be damaging. (McDonald 2006). Many surveyors view information as been essential to their ability to exploit opportunities. The possession of data can be utilised as a source of fee generation (Adair 1998). Therefore having to fulfill transparency requirement could be viewed as violation of their commercial instincts.

The heterogeneity of property is a fundamental problem when trying to establish accuracy (Adair 1998). Property is a multidimensional product with a number of variables. A property can be said to occupy a unique location, its design (property), the demographics of the population, and proximity to city centres, public services and transportation links (Ge 2007). The number of variable therefore inevitably means that many transactions can be unique. This of course is further exasperated by the element of secrecy attached as result of inclusions of such items as confidentially clause. The acceptable that all the information does not have to be disclosed does leave the process open to manipulation, thus ethics can be tested. (Alirat 2010). Market conditions have the ability to erode ethical standards. Interpretations adapted to meet the ever growing pressure of economic survival in an increasingly competitive market. Increased individual workloads together with decreasing fees could be seen as a catalyst to ones capacity to maintain previous practice ethos (Dabson 2007)

Ethical Guidance

To bring parameter to the research, this paper is only focusing on property professionals which describe themselves as Chartered Surveyors and are members of the Royal Institute of Chartered Surveyors (www.rics.org). It is a requirement of membership that the RICS's Rules of Conduct are adopted by the practicing surveyor. These rules establish nine core values. These form the basis of the surveyors ethical standards. The RICS's nine core values are (Dabson 2007)

- (1) Act with Integrity
- (2) Always be honest
- (3) Be open and transparent
- (4) Be accountable
- (5) Act within your Limitation
- (6) Be objective at all times
- (7) Always treat others with respect
- (8) Set a good example
- (9) Have the courage to make a stand

The individual surveyor does not enter the profession without any inherit ethics. These are instilled from both their own demographic and cultural background.(Dabson 2007) It is however when they become exposed to workings of commerce that these ethic may be manipulated.

With ethics based on the individual interpretation, what is to prevent a surveyor from adopting the view of those within the adversary legal profession. Whereby it can be acceptable within the rules, for a lawyer to put an argument they know to be false and champion causes they know to be untrue (Applbaum 2000). Therefore a surveyor may perceive a particular operation as been commonly acceptable as opposed to been illegal (Dabson 2007).

The argument can be put forward that the existence of such codes fails to alter behaviour. Those who are disposed to acting in an inappropriate manner will do so despite any code. Compared with those who will act responsibly irrespective of the existence of such a code. The criticism being, a primary part of the codes existence is for its use as a tool to enhance the image of an organization to outside stakeholders. They would compound this argument by the contrast in standards amongst the hierarchy of the membership and the everyday practitioner (Deinhart 1995).

Embracing Change

The inception of the professional charterer during the 19th century was grounded on the moral philosophy of that time. Today's property professional need to be mindful that the consequence of their actions can have wider implication for society as a whole (Dent 2013).

Ethical codes should not be devised solely for their ability to influence public perception of standards. They should be embraced as catalyst for change. Transparency has the capacity to cause difficulties for the property profession. The influences of how an institutes codes and ethics are perceived to be abided. Experience from behavioural studies have shown that our justification for knowingly acting inappropriately can be from not to be seen to "break rank". If it is acceptable behaviour to others, we follow the same process although we have our misgivings (Gigerenzer 2007). An organisations ethics are dependant on a voluntary acceptance by membership. The problem that continues to be highlighted is the ability to ensure consistency. How are they been interpreted. The fact that the existing rules of the RICS are value based, it can make it difficult to ensure consistency throughout (Dabson 2007)

To counteract these difficulties, good governance is required; an exercise in authority is needed. But how successful can this governance be in maintaining standards ? Governance can only be assessed in the context in which it operates. Transparency has been identified as an integral element to achieving this (ibis). Therefore initial reservations that may occur in terms of ethical concerns for increased transparency will ultimately be superseded by the overall benefit that it will bring to all stakeholders.

Conclusion

Information is not always freely available within the property market. Therefore property by its nature can be complex when it comes to decision making. Participants in the process will often have to make decisions with an element of uncertainty. Where there is a lack of available reliable data, the property profession is reliant on their subjective judgment. Market conditions have the ability to impact subjective judgement. The process of gathering evidence can be influence by the human behaviour whereby one can seek to find confirming as opposed to

disconfirming evidence. Difficulties are created within the market. Without full access to information on all transactions taking place, the property professional can be subjected to undue influence. The lack of available information in a commercial market has the ability to be distorted. Some stakeholders however in the commercial property market are opposed to full transparency. They maintain certain discretionary powers are required, as the full disclosure may not always be in the best interest of the market. It is argued that not all information pertaining to property transactions should be disclosed.

In tackling the ethical issues that may occur, surveyors are guided by the RICS's Rules of Conduct. These are presented as forming the basis of the surveyors ethical standards. However, an individual surveyor does not enter the profession without their own inherent ethics. It can be argued therefore that codes can fail to alter behaviour. It is not helped that they are based on the individual interpretation

It is in the provision of intermediary services that property professionals can become open to ethical criticism. Clients discomfort with sharing information and the existence of performance based reward systems all has the ability to influence their behaviour. Such actions are ultimately a threat to the profession. The agent erroneously believing they are acting in the best interest of their client. They can have a tainted view of transparency. To them, it is a hindrance to their work, a violation of their commercial instincts. Such attitudes are inadvertently damaging the profession. Demand for a profession is said to exist based on public demand. Therefore part of the survival of a profession is that it maintains public confidence. Ethics should not be their for the purpose of public perception of standards required but should be embraced as catalyst for change.

Organisational codes and ethic are not enough on their own. Good governance is required; an exercise in authority is needed. This can only be assessed in the context in which it operates. Transparency has been identified as an integral element to achieving this. Therefore initial reservations that may occur in terms of ethical concerns in terms of introducing transparency will ultimately be superseded by the overall benefit that it will bring to all stakeholders.

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Construction Project Management in Kuwait: The Cultural Issues from the Client Perspective

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Abstract

Construction project management is a young and emerging profession in Kuwait with little literature and research knowledge in the public domain. This research aims to fill some gaps in the knowledge about project management. It presents the outcome of an exploratory survey of construction project management in Kuwait, focusing on the client's perception of the impact of culture in Kuwait's construction industry. It forms part of a wider doctoral research project investigating construction project management in Kuwait from four perspectives: client, project manager, contractor and consultant. The research highlights the issues in the construction industry from the client's perspective, including: international codes not mandatory locally, unavailability of local codes and reliance on norms, the vagueness of the project managers' duties, as well as the conflicts and lack of trust between project parties and contracts, with special focus on the cultural dimension and how this can affect Project management in Kuwait.

Keywords

Project Management, Construction, Kuwait, cultural, buildings

Introduction

Experience of the construction industry in Kuwait and literature review (Kartam, 1998; Dunkley, 2004) has identified that many businesses or clients in Kuwait and the Gulf States have begun to recognize the importance of the role of the project manager and the effectiveness of project management in construction. Indeed there has been a dramatic rise in project management consulting in commerce and industry, particularly for the private sector. Additionally, project management firms have started to emerge, and project management has become a way of controlling the fast growing construction activities.

This growth has been acknowledged by industry, with organizations such as Business Wire (2011), stating that "Kuwait's construction sector continues to gather momentum backed by its strong economic growth. Its young and quickly growing population base ... economic diversification program and increased government spending are the key driving forces behind the construction sectors developments." Thus, establishing the need for a project management role in the construction of any project where cost, time, and quality are essential factors for the clients.

There has been an increase in demand to better understand project management and its bearing to the project's outcomes. Yet, there is still a need for quantitative data to understand the potential benefits of the concept of project management (Dinson, A., 2003). Thus, an increase in demand of research topics and empirical knowledge was emphasized by Soderlund (2002).

Al-Mebayedh (2003) asserts that Kuwait construction industry faces great competition and challenges, as much as any construction industry globally faces. Moreover, in Kuwait there is a huge reliance on foreign firms in construction. As a result, three kinds of cultural issues arise: the local cultural effect, the friction between the mixed cultures employees and the cultural conflicts with the foreign Project Management firms. Multiple issues are experienced because of new concepts brought by foreign construction employees into the country, which is one of the focal points in this analysis.

The importance of this research is driven from studying the correlation between the development of the state of Kuwait and its construction projects, and the impact of culture on the industry. Jannet, and Hennessey (1992) identify language, family, religion, education, history and politics as cultural elements which have an impact on human behavior. Therefore, these elements will have an impact on project management in Kuwait's construction field. It is imperative then that ample discussion be made on this issue, setting out possible recommendations later on to mitigate the negative effects of cultural issues while at the same time helping Kuwait meet its development goals.

Research Aim

The aim of the research is to examine the practice of project management in the state of Kuwait from the viewpoint of the Clients and to identify the impact of culture in the process. The main task of the paper is to:

- Assess how Client satisfaction is affected by cultural issues and practices in the Kuwaiti construction industry
- Investigate the root cause of adversarial relationships between project managers, designers and contractors.
- Critically analyze the added value of project managers to construction projects using cost, time and quality criteria.

Research Background

In investigating the role of project management in construction in Kuwait, an initial questionnaire was given to clients for their evaluation of project management. Clients' goals in Kuwait are similar to the results found by Michael Latham (1995) in the UK: complete specific structures within a specified time period and budget, as well as meeting the standards that are acceptable to the client. According to Michael Latham (1995) the clients' objectives in construction projects are:

- i. Value for money
- ii. Pleasing to look at
- iii. Free from defects on completion
- iv. Fit for purpose

- v. Supported by worthwhile guarantees
- vi. Reasonable running costs
- vii. Satisfactory durability

Bowen et al (1997), agrees that these objectives can be classified in terms of time, cost and quality or performance, which Klueker (2001) views as the constraints on any project. Projects vary in nature, size and complexity, attaching different levels of importance to each of the three key client objectives.

Conversely, when analysis of the questionnaire results began, it became evident that the cultural issues in project management were on the minds of the respondents. As a result, the questionnaire was followed by an interview designed in order to extract and clarify the role of differing cultural backgrounds affecting construction projects. While this research does not favor one method over the other it inter-weaves both methods to serve the research and discover a more substantial element of analyses. One approach can complement the other bringing a more substantial and beneficial research (Bowen, 2003; Massey, 2003).

Cultural influences on project management

According to Hodgetts and Luthans (1991), firms forming International Joint Ventures have problems in relation to cultural differences. Furthermore, Harrison and Lock (2001) believe that Project Managers need to think globally about all the departments and companies involved in completing their projects mainly because of the diversity in such projects. People with different cultural backgrounds work in a multi-company project; this has forced Project Managers to have a wider and broader vision of dealing with such people.

They also indicated that a Project Manager must think in terms of the project through considering all the inputs of a project as a single organization or team such as client, consultants, designers, manufactures, constructors, subcontractors, and suppliers as one entity despite their cultural differences. All of them should be motivated to have a great commitment and loyalty to the project ignoring diversity problems encountered (Harrison & Lock, 2001).

In Kuwait, the Difference in duties of project managers compared to the western cultures involve multiple issues such as ethics where it is not easy to rely on ones' honesty and loyalty to work, and arguments are very common among projects teams. Furthermore, Norms and lack of local codes along with project managers' responsibility and duties vagueness are not interfered by any Governmental authority such as the Ministry of Public Works. All this could leads to poorer quality projects. Another important issue in Kuwait is the Governmental obstacles which are noticeable in Kuwait as they would delay a project for several months or years.

Research Methodology

The firms for the study were selected according to a report by Kuwait Stock Exchange's (KSE, 2010). Kuwait has 30 Real-Estate major Firms that are involved in building construction. Seventeen of these firms specialize in high rise building construction and fitted the criteria that were selected for this questionnaire.

The sample for the questionnaire consisted of 56 client representatives selected from 10 Kuwaiti real-estate firms. Sixteen participants were chosen for the interview, these participants were divided into 4 equal groups of project managers, consultants, contractors, and clients whom are the focus of this research.

Certain sample selection criteria were set out in order to make sure the nature and content of the respondents' work are matched. The objectives defined in the preceding section were achieved through the accomplishment of the following tasks:

1. Thorough literature review, including identification of the local requirements, anticipations and expectations of clients or developers.
2. Reviewing the contractual relationship between the involved parties.
3. Exploring government contracting rules, regulations and permits required in the projects.
4. Selecting a number of clients from real-estate companies where the Project Management system is implemented in their projects.
5. Interviews with top managers at clients' organizations in addition to the structured questionnaire that were distributed to the clients at senior managerial levels to collect information.
6. Conclusions generation highlighted specific problems in the existing system and recommendations for better implementation.

Interview Findings

The interviews are intended to undertake a detailed study of the key issues arising out of main argument that the paper intends to raise. It serves the purpose of lending support to the Questionnaire method of data gathering. The main criteria for selecting interviewees are their role in the Kuwaiti construction industry and experience of project management. It enabled a more in-depth exploration of the subject, questioning the unexpected results, as well as confirming and justifying the findings.

Four clients were interviewed on their offices. Each interview lasted around one hour. All interviews were audio-taped and transcribed word-for-word in addition to notes made both during and after each interview.

Construction Code

One important issue is the Kuwaiti norms where the existence of an International Code for Construction is hardly considered. All four client interviewees varied in their answers when asked *if the project management in Kuwait is working in line with a recognized international code*, the answers varied between, no, yes, and maybe. Thus, that indicates that a specific line is undertaken is vague. It has been suggested, by some, that the American and British standards maybe followed. When asked if there was a local code of practice, the overall answer was negative. That suggests that the local code of practice is negative and no specific criteria is followed. In the ratio of 3, two of which suggested that we need a local code of practice. As stated by interviewee 1, "...if there is a code of practice for project management in Kuwait it will be good; in terms, it will affect the progress of work and will definitely enhance the quality of the projects."

Duties of Project Managers

In regards to the question about *the difference between duties of project managers in Kuwait and western cultures*, the three interviewees agree as to the differences in their duties, interviewee 2 claimed that the difference between local and foreign work is slight, “especially when we have a lot of foreign project managers working in Kuwait”, the other two believed that it is major. Interviewee 3 claimed that regional codes of practice are preferable over local ones and codes that are global are preferable over regional ones. He argued that the most important difference he had found between Kuwaiti and Western projects was the difference in project management concept in each culture: “I think the main difference is... in western culture Project Manager is another word for main contractor, here it is a separate entity for other than the contractor and the consultant”. He agrees with interviewee 4 and interviewee 1 that the project manager is the main contractor. Same Interviewees also agree about the different conception of project management, and argued that this had negative results: “in Kuwait you have another company who is doing it and it has negative impact sometimes as their only source of income is their salaries and overheads, so they tend to extend it by creating issues without the owner’s knowledge”.

Interviewee 1 stated the quality of work is weak, "since the ethics here are not as much of greater influence." This indicates that cultural and institutional differences in Kuwait vary in terms of project management.

Interviewee 4 argues that this lack of consistency stemmed from the fact that there are limited regulations from the Ministry of Public Works and the Society of Engineers in Kuwait, which “unfortunately here they do not have that much interference on the job itself” as opposed to similar organizations abroad which is again a cultural difference.

The consistent features of these responses are a consensus that Kuwaiti project management norms are significantly different from American and English norms of practice. Putzi’s (2001) concluded that most Kuwaiti business people have worked abroad and have substantial respect for Western rules.

Projects Delay

Politics also affect project management. In response to the question asked about *the reasons for delays*, all of the respondents’ replies blamed the government for delays on approvals (with Interviewee 1 alleging corruption), unqualified contractors, and financial obstacles. While all felt that there were additional factors, such as “lack of cooperation between project parties”. All four interviewees ranked government approval as the biggest issue causing delays. These points lead to substantial client dissatisfaction with government regulations.

Cultural issues

Interviewees were asked about *the impact of culture on the practice of project management in Kuwait*. There was much less consensus about the effect of culture on interactions. Hofstede (1983) and Loosemore and Muslmani (1999) found that there are differences between Kuwait and GCC countries in project management. However, the interviewees imply that these differences may be somewhat exaggerated in importance. Interviewee 1 confirmed that many Westerners may not be as experienced as they seem, and that Kuwaitis may over rate them. Although

there are some positive aspects as it was stated by interviewee 1, "some can perform better than other culture in specific areas." Yet, the negative aspects will be raised when there are conflicts in cultural back grounds.

Interviewee 1 also claimed that a sense of cultural or national camaraderie might lead some Project Managers to "cover up" the mistakes of each other. Interviewee 2 claimed that Kuwaiti culture leads to hierarchical conflicts and created a "three competing" firms in the project. Interviewee 2, contrary to Interviewee 1, claimed that more international firms tend to improve the professionalism of Kuwaiti firms, as well as codifying the distinction between Project Managers and other project workers. Interviewee 3 claimed that there was no "culture impact on project management itself" but that there are some institutional differences stemming from cultural practices, such as the pattern of hiring inexperienced Project Managers being promoted due to their Kuwaiti citizenship rather than experience, a lack of support for foreign employees that lead to unfair firing and payment practices, and the lack of unemployment insurance which in turn leads Project Managers and the people they preside over to be very timid and not take risks. Interviewee 3 claimed that Project managers in Kuwait "sell themselves to the owner by showing the problems that they have discovered", though there may be a problem with exploiting or exaggerating problems for personal gains, and that "it is completely different in the west" in ways that he did not quantify. All four respondents concurred that cultural differences were subtle and were more institutional than inter-personal, but cultural differences may have reduced the professionalism of Kuwaiti Project Management. There was broad consensus that international firms tend to be more professional, even though Westerners may actually not have much more experience.

Project responsibilities

In reference to delegation of authority, the following question was presented to the interviewees: *Do you think the quality responsibility should be devolved from the designer to the project manager?* Interviewee 4 stated that it is different in the western countries where the whole responsibilities of the project are the project managers'. He felt that there may be some benefits to increasing Project Manager responsibility in general (though perhaps not in the quality control aspect in specific) stating that "In my opinion, if the Project Manager holds some responsibility it will be good, because by having this you can classify the project management organizations like good, average, excellent, etc". he further stated that "the quality issue you cannot give to the Project Manager, because the Project Manager as an organization structure does not have the full experience". Interviewee 3 argued that the current arrangement is appropriate given the legal restrictions and codes in Kuwait.

Contracts

With regard to the aspect of contracts in Kuwait, the interviewees were asked which *constructions contracts are applied in Kuwait?* Their responses indicated that they are mainly based on FIDIC and that Kuwaiti norms do not influence any kind of contract standard reference. Interviewee 1 claimed that there was no consistent adoption. Interviewee 2 and 4 claimed that FIDIC and MPW are used, while Interviewee 3 claimed that the Ministry of Public Works uses a FIDIC-equivalent.

By and large, FIDIC and MPW were supported by the Interviewees, with all four expressing support for FIDIC.

All concurred that the current responsibility arrangement is unfair to the client and that Project Managers should carry more liability. This indicates widespread dissatisfaction with the current Project Manager arrangement in Kuwait. It is clear that clients in Kuwait feel that the current project management system is unfair and problematic and that this scenario in part stems from the existing culture.

Questionnaire Findings

Project Culture

Project culture is a pertinent factor of consideration for the success of any project (Schwalbe 2010). This is especially true for those projects outsourced because the team may be new to the organization and thus foreign to the existing organizational culture. The extent the project will succeed depends on how well the outsourced team adapts to the new culture. For outsourced projects it was pertinent to analyze how well the project manager can adapt to the existing organizational project culture. The results are indicated in the chart below:

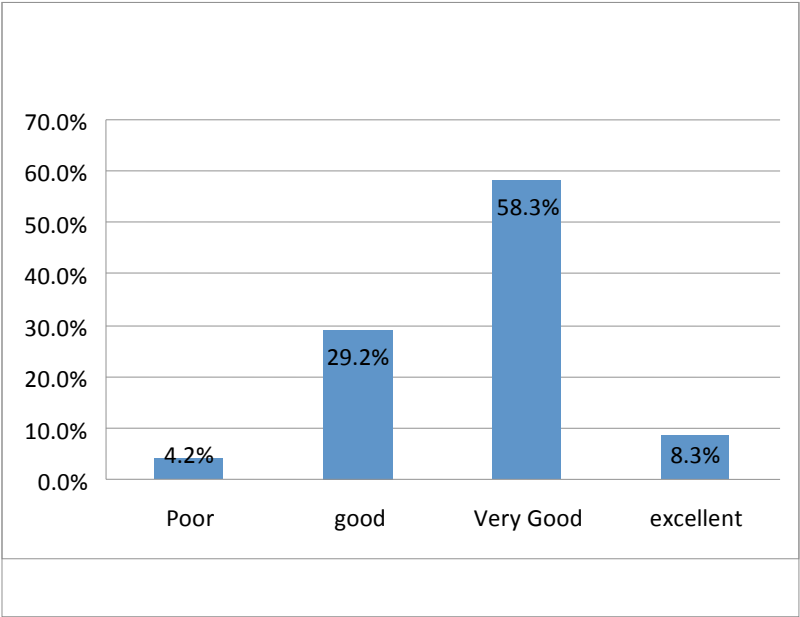


Figure .1 Project managers success rates based on project culture

The chart shows that 58.3% respondents indicated that the outsourced project managers had a very good understanding of the project culture and the organization’s need while 29.2% respondents indicated that outsourced project managers had a good understanding of the organization’s culture. However, only 8.3% respondents indicated an excellent understanding by the outsourced project manager.

Relationships

Organizational culture thrives on relationships and therefore the success of a project relies mainly on the project manager’s relationship with the organization (Thomas 2002). This can be measured based on reports, trust, and frankness during the

project life cycle. The survey reveals 55.6% respondents indicated effective relationship between the project manager and the organization while 14.8% respondents indicated a very effective relationship for the outsourced project manager. The chart below indicates

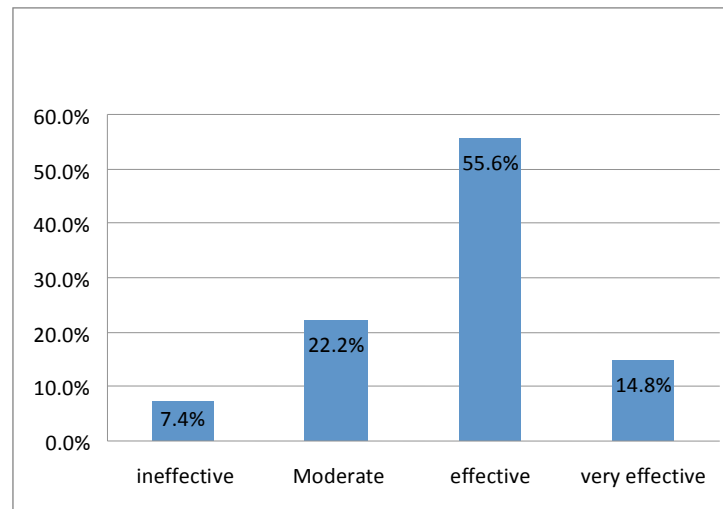


Figure .2 Project managers success rating in terms of relationships

A moderate relationship between the organization and the project managers in outsourced projects was indicated by 22.2 % respondents while 7.4% respondents indicated ineffective relationships between outsourced project managers and the organization.

Interface

The project manager has a number of characteristic roles. A major role within the project is providing an interface between the client or owner of the project and the project team. The chart below indicates these results:

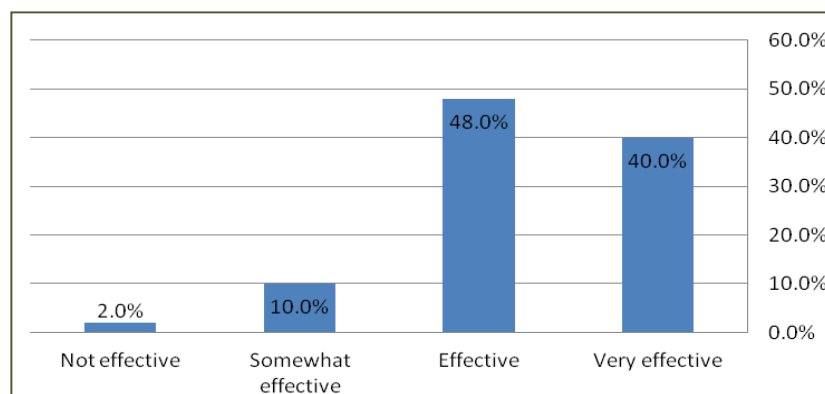


Figure .3 Project manager interfaces

Understanding the role and effectiveness of the project manager to provide an interface between the project team and the client was also surveyed. 48% respondents considered Project Manager as effective interface between clients and the rest of the project team while 40% respondents considered Project Manager as

very effective interface. Additionally, 10% indicated a somewhat effective response while 2% responded as not effective. Of the 40% who considered the Project Manager as very effective as an interface, 60% of them indicated that project managers act as client representatives and leads and integrate the project team with effective communication. Meanwhile, of the 48% who indicated that a Project Manager was an effective interface, 50% of them indicated that it was because the Project Manager was the coordinator of the project. The respondents who considered the Project Manager as not effective reasoned that the Project Manager was willing to act alone and thus was not considered an effective interface between the project team and the client.

Communication

Part of the project manager's role is effectively to communicate the requirements and the progress of the project. As such part of the project's success relies on how effective the project manager communicates with the team, client, and other stakeholders. Approximately 65% of respondents indicated an effective Project Manager in verbal and written communication, 17% indicated a very effective rating of the Project Manager, while 15% of responded with a somewhat effective rating. Only 4% indicated a not effective rating for the Project Manager in verbal and written communication with all relevant parties in a construction process.

The 17% who gave the Project Manager a very effective rating reasoned that the Project Manager creates one channel of information flow, providing a link between project parties, acting as client representatives and leading integration processes of the project. The 64.4% who rated the Project Manager as effective cited a number of reasons that included protecting themselves, giving more effective link to all parties, complying with contract conditions, and showing good knowledge of the subject and extensive experience, and documentation. The 15% who indicated a somewhat effective rating for the Project Manager, 67% gave the main reason as lacking in communication while 33% indicated dealing with different owners as the main reason. The 4% who rated Project Manager as not effective reasoned that the various contract parties do not believe in the project manager. The chart in Figure 4.

Client Satisfaction

Another key finding borne out of the questionnaire is the fact that project and organizational culture play a vital role in the success of in-house or outsourced projects. This was also compared to outcome of projects that did not have project managers. The general findings showed that 76% indicated an almost excellent level of satisfaction for in-house project managers. However, the percentage was lower at 67.6% for outsourced project managers. The following figure summarizes this assertion

One reason for this variation in preference was the project and organizational culture which tends to favor the hiring of project managers.

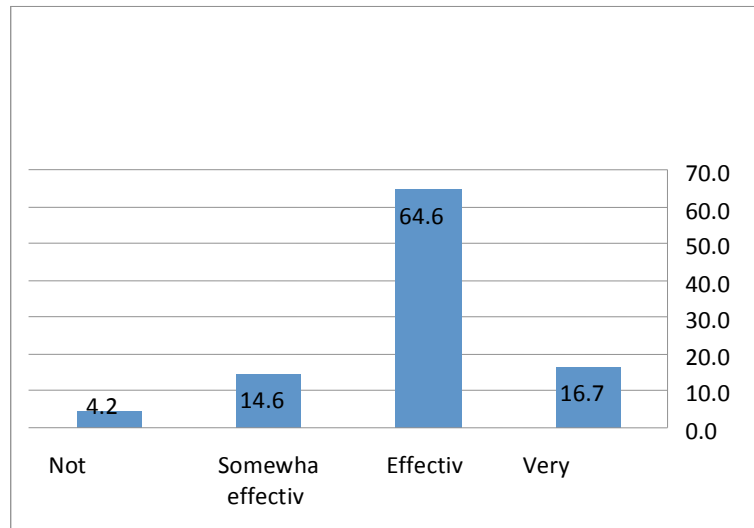


Figure .4 Project manager's effectiveness of verbal and written communication skills

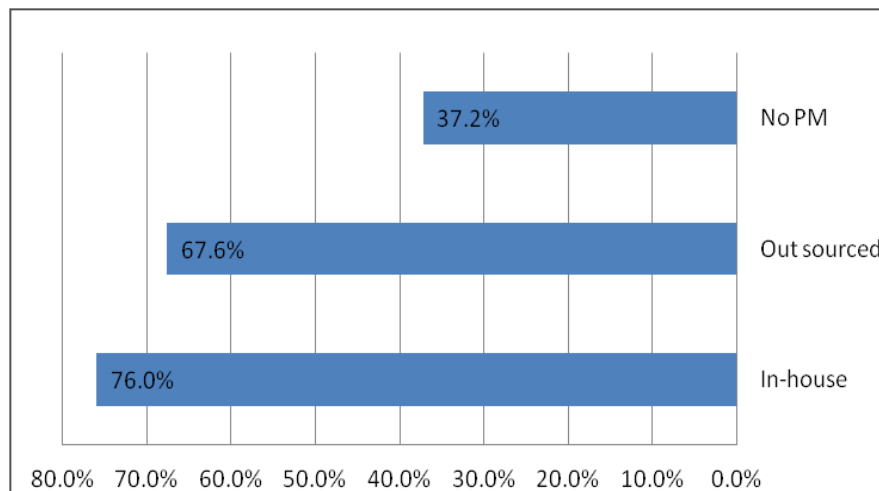


Figure. 5: overall satisfaction

Conclusion

The paper revealed several important flashpoints worthy of mention and careful evaluation on the assessment of the relative importance of Project management in Kuwait from the perspective of the Client. In addition to the findings and facts that were presented, the researcher discusses the following as the Conclusions of the study:

1. The existing cultural related issues affects the project management industry in Kuwait with respect to the project manager's role, cultural differences with other foreign employees, political culture within the country and organizational culture within the company.

2. Typically construction project delays are because of a number of reasons that may include financial obstacles, unqualified contractors, government or construction agencies approvals, bad manager, change of program and design, quality requirements, and miscalculations in initial time. The three top reasons for construction project delays are highlighted as government delays on approval, unqualified contractors and financial obstacles. This can be concluded to mean that if the Project management in Kuwait is to develop further, these issues are to be properly addressed.
3. There is lack of qualified project managers.
4. The clients also tend to have either In-house or Outsourced Project managers. The figures reveal that the clients as participants in this study adhere generally to the importance of Project manager with both In-house and Out-sourced project managers getting high approvals.
5. There is the lack of a standard international code which affects the culture both organizational and political that exists in the country.
6. Contracts are not prepared to suite the requirements of the Kuwaiti construction industry.
7. The government must take the lead in identifying problems related to the construction industry and find viable solutions to these concerns.
8. There are no clear and well defined set of roles for each of the parties involved in the construction process in order to ensure that there will be no overlapping of functions and proper delegation of authority.

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Recognition Of Factors And Their Contribution Towards The Evolution Of Small Sized Construction Contracting Organisations

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Abstract

The UK construction industry is characterised by its fragmentation into large numbers of small sized construction contracting organisations. Previous data has indicated a record of failure of such construction based enterprises especially in times of economic recession. A study is being conducted with small sized construction contracting organisations in order to explore the pertinent factors found to affect their survival and/or growth. The participants in the pilot study were selected from the University of Salford's Leading Enterprise and Development (LEAD) programme, which seeks to promote successful companies in business. The study was conducted from an interpretative perspective using a qualitative approach. The pilot study extended to six in-depth semi-structured interviews whereby key players in commercial/residential construction contracting organisations including the owners of two failed businesses participated in the study. The methodology adopted allowed the generation of "insider accounts" that provided rich deep contextual data. From the interviewed participants, a number of factors have emerged that have been classified under the headings of service orientation; supply-chain; quality benchmarking; trading period; critical self assessment; specialist service; employment status; local links to community and inadequate control measures. The main ongoing study involved case study interviews of seven Chartered Building Companies exploring project related critical success factors and a further thirty six Chartered Building Companies to be investigated for organisational critical success factors. Further data analysis and comparison with factors identified from literature allowed an initial conceptual framework of factors thought to aid the development of small sized construction contracting organisations SCCOs. The initial framework provided the basis of ongoing data collection and analysis of the Chartered Building Companies so as to ensure greater robustness to the emergent framework.

Keywords

Small sized construction contracting organisations; factors affecting development; chartered building companies.

1. Introduction

The aim of this study is to identify the progress undertaken in establishing the success factors which aid the success of micro and small sized contracting organisations in the construction industry. The research objectives are to: (i) critically analyse relevant literature to develop an initial conceptual framework of factors thought to influence the development of small sized construction contracting

organisations; (ii) rigorously analyse primary data on critical success factors thought to influence the development of small sized construction contracting organisations (SCCOs); (iii) evaluate the factors affecting the SCCOs against the factors uncovered in (i) and (ii) to evaluate the emergent critical success factors (CSFs) found to influence the development of small sized construction contracting organisations (SCCOs).

Research into SCCOs is limited. The shape and size of the construction sector is in continual flux and reflects the demands placed upon it. The specialisation of sub contractors and the growth of self employment have become widespread since the 1970s. This has transformed the construction industry into an industry characterized by fragmentation and large numbers of small sized companies. This research is concerned with micro and small sized companies, which have been identified as SCCOs employing between 1 and 50 staff. Table 1 indicates the main features of such micro and small sized organisations as set out by the European Union (2005).

Table 1. Micro, small and medium sized firms European Union (2005)

Enterprise category	Headcount	Turnover	or	Balance sheet total
medium-sized	< 250	≤ € 50 million		≤ € 43 million
small	< 50	≤ € 10 million		≤ € 10 million
micro	< 10	≤ € 2 million		≤ € 2 million

The Office of National Statistics (2012) determined the failure rates for small businesses operating in the United Kingdom Construction Industry for 2009 were 19.1% out of 19,008 firms and in 2010 there were 18.4% failures. This shows the trading period of construction contracting organisations, especially for newly formed micro and small sized organisations cannot be taken for granted. Interestingly similar percentage figures have been found in the United States where the Surety Information Office (SIO) (2009) determined that failure rates for small businesses operating over a two year period to be 21.7%. Initially literature has been reviewed in this paper to identify factors thought to influence the development of SCCOs leading to the generalisation of factors affecting the growth of small sized construction contracting organisations.

2. Literature Review

Achanga *et al.*'s. (2006) research although limited both in terms of geographical location and size, acknowledged that many small to medium enterprises (SMEs) were vulnerable in that they operated in sectors with few barriers to new entrants but little power to dictate suppliers their needs. Porter (1980) set out the “five forces” framework (fig. 1) representing the impact of participating parties that contributed to the construction industry and the continual demands placed by each sector on one and another. Karagiannopoulos *et al.* (2005) described the impact of Porter's “five forces” claiming the most significant of Porter's “five forces” in terms of the intensity of rivalry among competitors.

In addition to Porter's five forces model, Hewitt's research work (1997), conducted with selected companies from general business and not specifically construction based enterprises concluded further factors such as (i) customer focus, (ii) process

management, (iii) continuous improvement, (iv) innovation, (v) supplier partnership, (vi) people development and involvement, (vii) leadership and (viii) consistency of purpose as issues that are required to be addressed by small business organizations in their development.

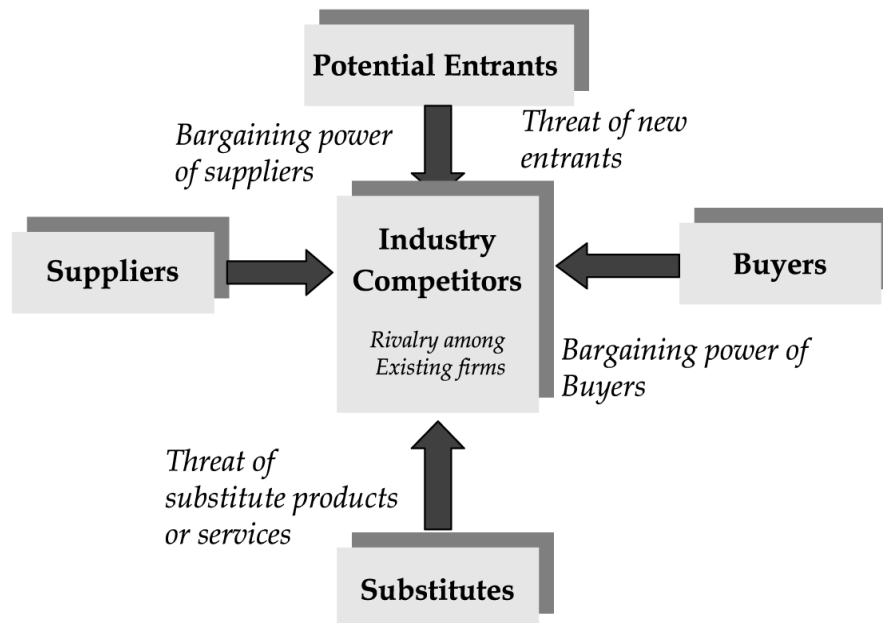


Figure 1. Porter's five forces (Source Porter 1980).

Achanga *et al.* (2006) investigated critical success factors for lean implementation within SMES whereby the critical success factors which were thought to affect the development of a SCCO were detailed as, (ix) leadership and management, (x) finance, (xi) skills and expertise and (xii) culture of the recipient organization. Achanga (2006) identified leadership and management commitment to be the most critical of the identified success factors.

The literature was explored to identify factors associated with company development characteristics where Lee *et al.* (2012) determined that associated company development against its competitive advantage to be; its reputation; its ability to attract and retain workers or members, customers, clients, or users; the maintenance of employees' morale, commitment and productivity and the relationship between suppliers, customers and the community in which it operates. Tokuori (2010) however offered factors that impede the development of SCCOs as: the lack of qualified personnel and construction-related equipment; high factor costs affecting the business operation; difficulties of starting up a business; highly bureaucratic tender process; delay of payment and inadequate accessibility to financial services.

In exploring the literature relating to factors that were thought to determine success in SCCOs it is important however to reflect on business failure. Arditi *et al* (2000) drew on a number of academic sources to define business failure but cited the seminal work of Frederikslust (1978) who suggested that business failure is the inability of a firm to pay its obligations when they are due. Although this statement was made prior to the current recession it's content is relevant to any business cycle supporting a further factor being (xiii) the need to maintain a positive cash flow as being a factor relevant to the survival and development of a SCCO.

The thirteen factors (i) – (xiii) identified above from Hewitt (1997), Arditi *et al.*, (2000) and Achanga *et al.*, (2006) can be classified within the six headings from Hewitt's (1997) business excellence model which was developed to promote improvement and best practice in industry and was categorised under six headings: (a) People Management (b) Policy and Strategy (c) Resources (d) People Satisfaction (e) Customer Satisfaction and (f) Impact on Society to develop an initial conceptual frame work of factors based on literature that were thought to impact on the success of micro and small construction contracting business enterprises. These factors and classifications are in table 2 below.

Table 2. Classification of Success Factors

Factors from literature	Classifications from literature
(i) Customer focus	(e) Customer Satisfaction
(ii) Process management	(b) Policy and Strategy
(iii) Continuous improvement	(b) Policy and Strategy
(iv) Innovation	(c) Resources
(v) Supplier partnership	(d) People Satisfaction
(vi) People development and involvement	(a) People Management
(vii) Leadership	(b) Policy and Strategy
(viii) Consistency of purpose	(f) Impact on Society
(ix) Leadership and management	(b) Policy and Strategy
(x) Finance	(c) Resources
(xi) Skills and expertise	(c) Resources
(xii) Culture of the recipient organization	(f) Impact on Society
(xiii) Positive cash flow	(c) Resources

There are critical success factors associated with other management disciplines that can be adopted for SCCOs: Chan *et al.* (2004) whose research was project related based their conclusions on seven major journals in the construction field which was instrumental in developing a conceptual framework for factors affecting project success and this was structured under five categories. The factors within the categories have been found to be both inter-related and intra-related; Arslan and Kivark (2008) examined at organisational level the factors affecting its structure and why a business would find it desirable or necessary to implement these factors?

It was resolved to explore the relevance of the factors identified above from Hewitt (1997), Arditi *et al.*, (2000), Chan *et al.*, (2004) and Achanga *et al.*, (2006), Arslan., G and Kivrak., S. (2008), Flamholz., E and Randle., Y. (1998) and Flamholz., E and Aksehirli., Z. (2000) which are suspected as impacting on the survival and development of SCCOs

3. Research Methodology

Given the nature of the research problem identified above it was resolved to adopt a qualitative research approach whereby a true grounded theory approach was adopted that sought to gain data from practitioners in the field before literature related to the subject area was accessed and analysed (Straus and Corbin 1990). The interviews were sought to obtain information from the collection and analysis of insider accounts from leading actors within SCCOs. The qualitative researcher has adopted an interpretive approach to the analysis of information obtained from

organisations labeled as companies A-F who are categorized as small sized construction contracting organizations.

Ekanem (2007) developed the “insider accounts” approach from qualitative based research techniques into a research method in its own right to overcome the shortcomings of research with small firms. The philosophical approach was to treat people as subjects and as such therefore enable the interviewee to produce accounts of their world. This research is much more practical in small firm research, which by definition employs less than 50 people; research that uses alternative qualitative approaches such as ethnography and action research would become conspicuous and perceived to be in the way where the presence of researchers within such SCCOs would be likely to become less welcome. Through less familiarity with the organisation and its staff this interviewing technique provides detachment between the researcher and the organization and enables a good understanding of the small firms and their owner-managers to be developed. It was determined to use “insider accounts” as the technique to be used for the research.

The choice of using semi-structured open ended questions was used to encourage meaningful responses (Patton 1990). The interviews were conducted over one session so as to put the interviewees at ease and they were assured of their anonymity. This approach allowed the sessions to progress in a less constricted context. By posing the questions in a semi-structured fashion, the conversation was allowed to develop into areas where new information may have been found. This choice of interview technique facilitated a more relaxed discussion, which allowed a relationship of trust to develop.

4. Research Findings

From the pilot study raw data was amassed from semi-structured interviews with companies A-F being a purposeful sample of six micro/small sized construction contracting organisations, all of whom met the criteria established in table 1. The interviews were conducted in four stages initially being company A operating as a general contractor. Company B a specialist contractor was subsequently seen then companies C and D offering specialist services were interviewed on the same day. To make the investigation more robust two failed companies were approached to ascertain what differences (if any) were identified and to establish what factors contributed to their failure? The results of the study have been identified in table 3 and they were interviewed at their place of work between 23rd June 2011 and 07th February 2012. The information gleaned from the interviews was broken down identifying significant aspects of the data which was then categorized. This was undertaken by initially transcribing and reading the transcripts to identify categories of response, testing the categories by classifying responses, explaining the raw data and finally, clarifying how the data was analysed.

From the result of table 3 the following factors were identified. Factors 1 (service orientation) and 2 (supply-chain) were consistent with all interviewed companies. Factor 3 (quality benchmarking) and 4 (trading period) were shared with all the successful companies. Factors 6 (specialist service) and 7 (local links to community and business) were identified with companies B, C, and D only but factor 8 (inadequate control measures) was specific to the two failed companies only. The research indicates that inadequate control measures were the identifying factor that differentiated between successful and failed company status.

Table 3. Factors pertaining to successful and failed companies

	Success factors identified above for successful company A:	Success factors identified above for successful company B	Success factors identified above for successful companies: C and D	Factors identified above for failed companies: E and F
Factors Pertaining to interviewed companies	1	1	1	1
	2	2	2	2
	3	3	3	x
	4	4	4	x
	5	5	x	x
	x	6	6	x
	x	7	x	x
	x	x	x	8

Key to factors highlighted in table 3.

Service orientation

- a. Commercial and/or residential customer base
 - b. Problem solving
 - c. No hard sell
 1. Supply-chain.
 2. Quality benchmarking.
 - a. Affiliation to institutional organisations.
 3. Trading period – basis for selection of cases
 4. Critical self assessment.
 5. Specialist service.
 6. Local links to community and business.
 7. Inadequate control measures – Failure: (i) cash flow (ii) communication (iii) interest rates (iv) use of inadequate and irrelevant contracts
- x = not applicable

The results from the literature review and data analysis have identified the following criteria as being relevant SCCOs seeking to grow and survive in business. Six companies have been interviewed; four found to be ongoing successful companies and two who experienced failure. A number of open ended questions were asked and comments from the company owners may be found in the following sub-headings 1-8 which are the key factors for table 3 that have been established from the interviewed organisations.

1. Service Orientation - All the interviewed companies pursued a commercial and/or residential customer base with the exception of Company D who commented: "We do most of our work for either new housing developers or commercial developers of industrial sites". Company E was the only firm who didn't offer problem solving as a benefit to his failed business. Companies A, B, and C have a "no hard sell policy" The company B owner remarked: "we have never had to break into a sweat to bring business in".
2. Supply Chain (Employed Status) - Companies A, B, C and F had a mixture of self employed and employed labour whereas company E only used sub-contract labour and company D only employed their own staff.
3. Quality Benchmarking - All companies had or aspired to belong to a professionally aligned industry institute with the exception of the two failed companies E and F.
4. Trading Period - All companies had been trading for more than twenty years with the exception of the two failed companies E and F.
5. Critical Self Assessment - Company A has promoted standards of excellence including customer focus, continuous improvement, leadership and consistency of purpose as a development process within the business.
6. Specialist Service - Companies D, E, and F representing 50% of the interviewed companies offered a specialised service.
7. Local Links To The Community - Company B offered local links to community and business and confirmed "we've always had a strong sense of community for what we do and the fund raising that we do is never for a national charity.
8. Inadequate Control Measures - By comparison data from the failed businesses (companies E-F) revealed that they have not managed to keep control. The business owners had either been unable or unwilling to communicate the business interests within their own business community and it is evident that associates have had their own agendas which has resulted in business failure due to a lack of control by the business owner. Further reasons for business failure were cash flow, late payment and inadequate written contract agreements.
9. After establishing the success factors from companies A-F identified in table 3 and the literature these have been collated and compared for their compatibility with each other and the findings have been listed in table 4.
- 10.

Table 4. Relationship between Success Factors from literature and practitioner interviews

Factors from literature	Factors identified by interview
(i) Customer focus	(1) Service orientation
(ii) Process management	(2) Supply chain
(iii) Continuous improvement	(2) Supply chain
(iv) Innovation	(1) Service orientation
(v) Supplier partnership	(2) Supply chain

(vi) People development and involvement	(2) Supply chain
(vii) Leadership	(5) Critical assessment
(viii) Consistency of purpose	(6) Specialist service
(ix) Leadership and management	(3) Quality benchmarking
(x) Finance	(8) Inadequate/Control measures
(xi) Skills and expertise	(6) Specialist service
(xii) Culture of the recipient organization	(7) Local links
(xiii) Positive cash flow	(8) Inadequate/Control measures

Figure 2 has been developed from tables 2-4 illustrating classification headings from

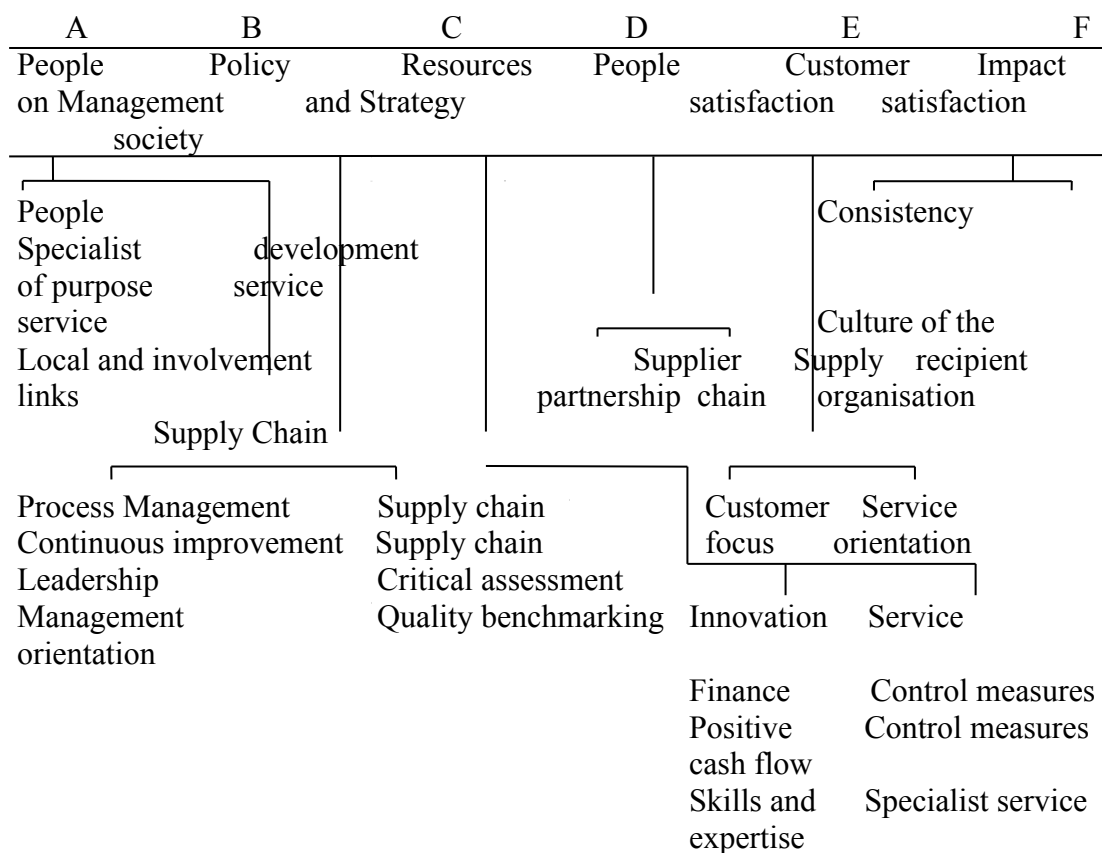


Figure 2. Classifications for Literature and Practitioner based Success Factors
Hewitt's (1997) Business Excellence Model. The factors identified in table 4 have been brought forward to show the inter-relationship between factors from literature, depicted to the left and the practitioner findings on the right.

Further interviews have been conducted with seven small sized chartered building companies (CBCs) posing questions to critical success factors relating to project related issues and further interviews are to be conducted with thirty six (CBCs) on the organisational structure representing companies throughout the United Kingdom.

5. Conclusion

In addressing and determining what is meant by a micro, small and medium sized organisation and developing success factors thought to affect an organisation's business viability the foundations have been laid to guide the research to pursue a line of investigation that enabled it to develop a study into ongoing and failed companies. The literature review identifies the relevance and inter-relationship of SCCOs within Porter's five forces model, the exploration of the factors identified from (a) Hewitt (1997), (b) Arditi *et al.*, (2000), (c) Chan *et al.*, (2004) (d) Arslan and Kivark (2008) and (e) Achanga *et al.*, (2006) suspected as impacting on the survival and development of SCCOs. The critical success factors found in the literature review are applicable to (a) total quality management (b) business failure and (c) project management within SMEs and the semi-structured interviews have resolved to disclose the results identified in table 3 which are pertinent to the interviewed companies. The factors from practitioner interviews and literature were then collated to show their inter-relationship with each other under the umbrella classification headings from Hewitt's (1997) Business Excellence Model. Further interviews are to be conducted with regard to organisational structure based on Flamholz., E and Randle., Y. (1998) and Flamholz., E and Aksehirli., Z. (2000) which are suspected as impacting on the survival and development of SCCOs.

By reviewing the results of the study there is evidence to support factors that are shared by the organisations suggesting consistency of unit factors that can be evaluated to determine the ability of a company to fail, continue trading and/or to succeed in business development. This study has provided the basis to develop further research with more interviewees from chartered building companies throughout the United Kingdom. Such work will contribute to the aim of the doctoral study which is to develop a framework to aid the success of micro and small sized contracting organisations in the construction industry.

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Risk Assessment of Construction Projects in Bangladesh

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Abstract

The assessment of risk and its proper management is a matter of great concern. Due to the improper management of risk a project may experience a huge amount of loss of money. Considering these factors and paying attention to the necessity of risk management, the study has been carried out in the construction projects in Bangladesh. The main attention was paid to the identification of different types of risk and rating the various risks arises in a project and assessing major risk factors. Besides, this research developed a risk management framework for proper management of Bangladeshi construction projects. For this study, a questionnaire survey has been conducted and analyzed. Finally, this study found increase material cost, increase of labor rate, project delay, short time of tendering, lack of experience, loss due to fluctuation of construction materials inflation, improper planning and budgeting etc. as the top most risk factors.

Keywords

Bangladesh, Construction, Management, Questionnaire, Risk

1. Introduction

The development of infrastructure is an important activity of a country involves huge amount of money and creates a considerable amount of risk in a project. Due to the multiplicity of works and organizations involved in construction project, the clients are encountered frequent risk to terminate the project successfully. Construction personnel have to pay attention to minimize risk because it has great influence on cost and time overruns of the project (Akintola & Malcolm, 1997). Risk can be considered as both negative and positive aspect (David, 2002). Project monitoring and control by assessing risk in proper way might good omen for diminishing probability of time and cost overruns or even project failure. The term risk management can be defined as the systematic processes of identifying and analyzing the risk to find out way forward (Project Management Institute, 2004). The risk management process begins with the initial identification of the relevant and potential risks associated with the construction project. It has considerable importance since the process of the risk analysis and management are performed to identify potential risk. In addition, risk analysis and evaluation is the intermediate process between risk identification and management. Once the risks of a project have been identified and analyzed, an appropriate method of treating risk can be adopted. Within a framework of risk management, contractors also have to decide how to handle each risk and formulate suitable risk treatment strategies or mitigation measures. The process of risk management does not aim to remove completely all risks from a project. Its objective is to develop an organized

framework to assist decision makers to manage the risks, especially the critical ones, effectively and efficiently. There are many researches, for example, Elikington and Smallman (2002), Lyons and Skitmore (2004), Akintola & Malcolm (1997), etc. have been studied worldwide to assess and manage the project risk. Since, the risk associated with a project depends on its type, size, complexity, location, and involvement of parties, number of concurrent activities, type of contract, administrative systems and skilled etc. which are not universal globally and there is no such research found in Bangladesh (BD), it was very important to conduct study in this field. Besides, Bangladeshi construction industries are facing various risk to finish the project within due time and money, that is why, the study objectives were to evaluate and assess the risk associated with BD construction projects, ranking of risk level on the basis of probability of risk occurrence and their impact, and conclude the most severe risk factors depending on the outcomes of questionnaire survey.

2. Literature Review

In general, construction projects in developing countries fail to reach target regarding predefined budget and time with desired quality due to failure of identifying and estimating unanticipated risk. Analytic Hierarchy Process (AHP) was introduced by Mohammad & Jamal (1991) as an approach for assessing risk at initial stage of project instead of traditional methods. They conducted the research of using AHP to calculate the riskiness of a Jamuna bridge construction project in Bangladesh and concluded the project as low risk one. Besides, research found AHP is a useful method of risk administration for the project manager to make conclusion for bid appraisal, selection of equipment and staff, business performance and challenge etc. According to Leung et al. (1998), “an effective risk management approach can provide a framework for project managers to identify and assess potential risk factors and take response actions in order to achieve the desired objectives of a given project”. Leung et al. (1998) applied knowledge-base technique and developed a model for discovering probable risk of a project by using previous experience and proved its feasibility for risk management in real field. Robert (2001) discovered that the effectiveness of risk analysis depends on the process of risk identification and assessment as well as proposed the most effective sequences of risk management system as “knowledge acquisition, selection of the core design team, presentation of the process, identification, encoding and verification”.

Chris C. (1997) has provided a summary of risk management process which was the synthesized of methods and concluded that risk management is the right of the project itself depending on objectives, assigned task and system of project delivers. Usually risk is viewing as negative aspect and meaning financial loss, occurrence of hazard, adverse effect etc. However, research find out the beneficial use of risk assessment. Although, procedures available for risk experts are mostly to pay attention in negative side, David (2002) studied to widen the possibility of risk process using project opportunity administration. S C Ward (1999) studied the inadequacies of ranking risk factors based on probability and impact method. He concluded that management will be most effective if both size and probability of occurring impacts are distinguished with response timely. Since risk factors are varied in project to project, associated risk also varied. But project manager frequently worked with common and even irrelevant issued for risk minimization

which are proved ineffective and intentionally avoid most effective causes of risk for difficulties. For effective risk management, it is necessary to discover most important relevant as well as irrelevant information to give emphasize and exclude respectively (Elmar & Mark, 2010).

An extensive study has been done by Offer & Mark (2011) for evaluating the efficiency of current practice of management to minimize the project risk. That study collected data from multinational industries from different countries and regions. The research found that the level of risk and its intensity varies with respect to above contexts and proper planning of risk management are adequate to diminish risk for successful project completion. Martin (2007) has been studied post mortem analysis for risk assessment which is commonly used in software based management system. This analysis found most efficient for providing detailed information to enhancement capacity of the project future and evaluated the value of participating all categories project personnel to know how best management techniques. Paul & Clive (2002) studied the practices of risk management system available in British utility service projects and found the inefficiency of frequently used Price2TM method for handling project risk. This research suggested, first to identify causes of risks, then estimate, evaluate and finally take protective action which is a continuous process.

A research survey was conducted by Terry & Martin (2004) within senior executive of Queensland construction industry regarding the commonly used techniques of risk handling. Research identified higher practice of risk management in planning and implementation stage of project than starting and ending phases; priority given to identify and assess of risks prior to action taken, for assessing and reduction of risk, qualitative and response method were commonly used practice respectively. A questionnaire also has been done by Nabil & Saied (2001) through largest construction industries in Kuwait from the view of contractors to evaluate the action taken for time and cost related risk management. The study presented two types of methods for risk control such as preventive method at planning stage and remedial action for the phase of during construction. Besides, in Kuwait, research found that contractors were eager to receive legal and agreement related risk and application of proper risk analysis practice was limited. However, a new concept in identifying and assessing potential risk concurrently by applying multi-attribute group decision making (MAGDM) in construction project of both qualitative and quantitative approach was introduced by Mohammad et al. (2010), and found very successful for risk management in Iranian construction project.

Accuracy of risk assessment in construction fully depends on the method of risk analysis and management. There are numerous systems such as brainstorming, Delphi, nominal group technique etc. available for risk analysis. Robert (1998) used Charles Handy model to make comparison of those process and found brainstorming as mostly applicable technique but has severe drawbacks. A more advance fuzzy approach was introduced in risk management of construction project by Carr & Tah (2001), where the study has been developed a qualitative risk assessment model for describing a hierarchical risk breakdown structure and revealed relationship within risk factors and subsequent effects by using fuzzy method.

High risks involve in international projects and varying among projects location, type, management systems etc. (Zhi 1995, Artem 2001). Artem (2001) developed a

new technology for identifying, classifying and assessing international project risk and also proposed “risk management support system” applicable in Russian context. This system contained data base related to risk in using the efficiency of risk and its application at different phases of project and processed uniformly with the options of update and timely response against risk. However, Berkeley et al. (1991) was proposed four stages of risk management such as risk classification, risk identification, risk assessment, and risk response. This concept associated with probability analysis and impact assessment was applied by Zhi (1995) for risk management in overseas construction project run by Chinese construction industries. Besides, due to lack of research to cope risk for overseas construction companies and experts, specifically for Malaysian firms facing economic and reputation loss in Gulf region. Hamzah et al. (2012) identified and evaluated the risks management system for that part of the world and developed a structure of decision-making technique to overcome risk for abroad organization and personnel.

Regarding time and cost limitation, all type of risks is not feasible to manage, thus priority of high risks factors should be given to minimize project risk. For this reason, risk rating is important to help project manager for planning and response of risk management. This scenario introduced by David & Richard (2001) in construction industries of Western Australia where identifying risks were rating by project personnel from low to high with a numerical rate of 1 to 5 respectively and risk was calculated by multiplying the probability and importance of particular risk factor.

3. Methodology

For this research, relevant journal articles were reviewed initially to identify the risk factors that affect the performance of construction industry as a whole. This study has adopted the more general and broad definition of risk as presented by Shen *et al.* (2001) on China’s construction joint ventures and more risk factors from other literature. Also some interviews of industrial practitioners were conducted to produce to check effectiveness of questionnaires. From literature review, 70 risk factors were found where not all factors are related to Bangladeshi construction projects. Then at first phase, small scale survey was done by asking experienced construction expertise for finding the short-list of locally relevant factors. As a result, only important and relevant factors (i.e. 30 factors) were chosen for inclusion in the full- scale survey in the second phase of the research. For this survey, construction personnel from randomly selected 25 construction projects (25) of Dhaka and Sylhet (north-eastern part and fast rising) cites in Bangladesh were asked to answer the questionnaires.

4. Questionnaires Design

The questionnaires were developed according to the study of Deviprasadh (2007) and tested with a pilot survey for clarity, case of use, and value of the parts. The first part consists of general information like type of company, experience, value of their project etc and the second part consists of the construction risk factors for evaluation. Risk factors for this study were classified into four major categories, namely: (a) financial risk, (b) management risk, (c) technical risk, and (d) environmental risk. The survey questionnaire is designed to proof the cross-sectional behavioral pattern of construction risks construction site. The questionnaires were prepared for the survey as formulated by seeing the relevant

literatures in the area of construction risk. The interview was free to ask additional questions that focused on issues arising during the course of the interview. The freedom to follow the interviewee to ask clarifications, and to focus on specific project, risk practices and knowledge, made the interviews insightful. The respondents were requested to judge the significance or “expected loss” of each risk. In this study, approach adopted by Shen et.al (2001) was considered for two attributes of each risk such as, the probability level of the risk occurrence, denoted by α ; and the degree of impact or the level of loss if the risk occurs, denoted by β . The principle of risk significance (RS), was described as the function of the two attributes i.e. $RS = f(\alpha, \beta)$. By applying this procedure, the respondents were asked to respond to the two attributes for each risk. For considering α , the respondents were required to judge the probability level of risk occurrence by selecting one from among five levels namely, Very small, Small, Normal, Large and Very large where these nominal scale of measurements also rated as numerical value from 1 to 5 respectively. For considering β , the respondents were required to judge the degree of impact if the concerned risk occur, by selecting once among five grades, namely, Very low, low, medium, high and very high and rated as same to α (Shen et al., 2001).

5. Data Analysis process

This study used the model developed by Shen (2001) to evaluate the relative significance among the risks which depends on risk significance index and the index developed by calculating significance score for individual risk. For calculating the risk significance score, the probability of occurrence was multiplied by the degree of impact and can be expressed by the following model:

$$RS_j^i = \alpha_j^i \beta_j^i$$

Where, RS_j^i is the significant score of risk i , assessed by respondent j ; α_j^i denotes the probability of occurrence of risk i , assessed by respondent j , and β_j^i means degree of impact of risk i , assessed by respondent j . The mean score of all respondents were calculated to get average significance score for single risk, and this average scores are defined as the risk index score and used to list the rank of risks. The risk index were obtained by the following model (Shen 2001):

$$RI^i = \frac{\sum_{j=1}^T S_j^i}{T}$$

Where, RI^i and S_j^i denote index score and significance score assessed by respondents for risk i respectively and T denotes total number of respondents.

6. Result and Discussion

This study developed the questionnaires and supplied to the project personnel of twenty five companies out of which twenty had an effective reply and five was rejected due to improper answering. Thus the response rate is 80% which may considered as a good response in this type of survey. In those twenty companies surveyed the respondents were contractor, project manager, assistant project manager, project engineer, assistant project engineer, site engineer, engineer, and owner. After the analysis of the survey out puts by the methods previously mentioned, financial risk groups were the most severe factors and environmental groups found as the lowest influence. Regarding individual ranking of risk factors,

top 10 risk factors are listed in table 1 and inflation of construction materials was found as the number one problem by the respondent. Besides, increase labor rate, project delay, and short time of tendering were severe risk factors in order but very close in rating. For the owners, time constraint has the maximum risk rating and other important causes of risks were shortage of skilled workers, project delay, errors in design and drawings, improper project planning and budgeting, and loss due to fluctuation of inflation rate.

Table 1: Overall ranking of most important risk factors

Rank of Risk	Name of Sub Risk	Mean of RI
1	Increase materials cost	23.1
2	Increase of labor rate	11.85
3	Project delay	11.65
4	Short tendering time	11.4
5	No past experience in similar projects	10.1
6	Loss due to fluctuation of material inflation	10.05
7	Improper project planning and budgeting	9.2
8	Sub contractor related problem	9.2
9	Loss due to rise in fuel price	8.2
10	Improper project feasibility study	8

6.1 Financial Risk

Inflation rate in Bangladesh is going higher than many other developing countries causing the construction industry a hefty price. Rising fuel prices have also been raising inflation in Bangladesh. Domestic prices of petrol and diesel have been increased by 5% in Bangladesh last year (2011). The real estate companies have suffered a major setback from Bangladesh Bank's money tightening policies. Their top-lines and bottom-lines have shown a much slower growth than their respective interest costs. Ranking of financial risk are given in the table 2 and increase of material cost is found as highest risk factor among all of the financial risks.

Table 2: Ranking of financial risks

No.	Sub-Risk	Mean RI
1	Increase materials cost	23.1
2	Increase of labor risk	11.85
3	Loss due to fluctuation of material inflation	10.05
4	Loss due to rise in fuel price	8.2
5	Bankruptcy of project partner	6.05
6	Loss due to function of interest rate	4.65

6.2 Management Risk

Ranking of management risks are shown in figure 1 which revealed that delay in project termination within scheduled period was the most severe factor and makes the project vulnerable. Besides, short time of tendering, lack of experience,

improper planning and schedule were the main risks factor for delivering the project with success and proper practice of construction management system can solve the problem easily.

However, there is unavailability of professional construction management experts in Bangladeshi construction industry. Finally, this study discovered that over all managerial weakness is one of the most important factor need to pay attention for minimizing project risk.

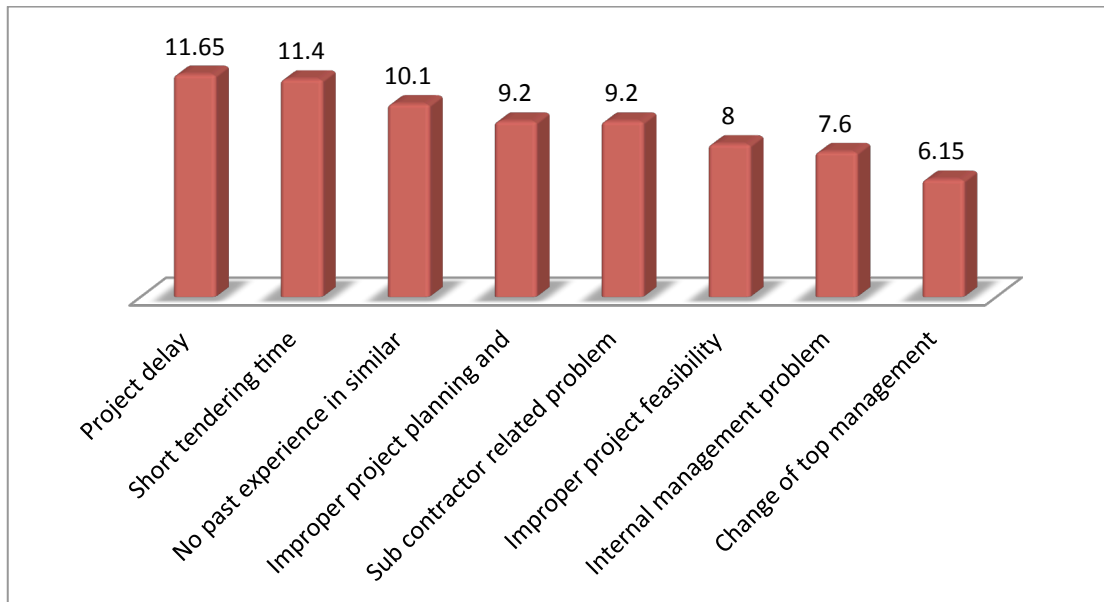


Figure 1: Bar chart of Management risk

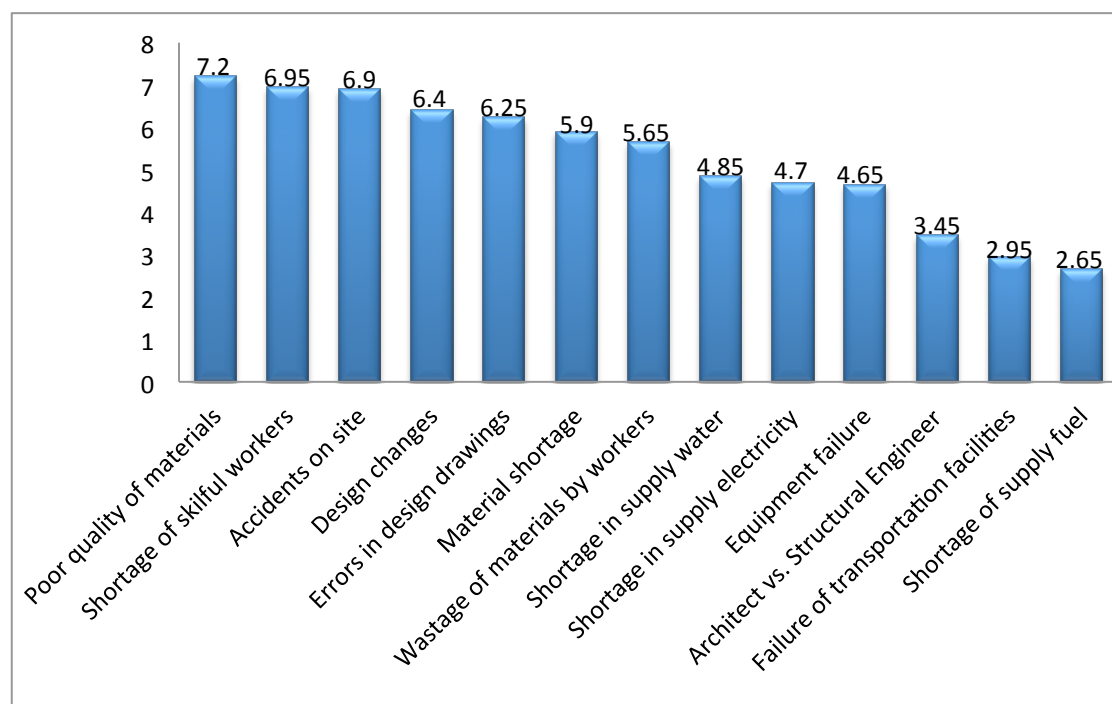


Figure 2: Bar chart of Technical Risk

6.3 Technical Risk

Few technical factors are creating project risk where poor quality of material, shortage of skilled labor, on site accident etc. marked as priorities by all the respondents. This risk group is presented in bar diagram above (figure 2). By visiting construction sites, it is found that Bangladeshi workers are doing their job in high risk conditions. Most of them are living at the construction sites with very unhealthy environment. Besides, few companies ensured safety at site which is leading to many accidents, even death and increase the project duration with subsequent risk. However, there are some risk factors such as design change by owner, error in design and drawing by consultant are easily controllable issues. In addition, material shortage, wastage of materials by worker frequently happened during construction but proper management at site can solve these problems.

6.4 Environmental Risk

This risk is two types such as construction related and labor related. During rainy season foundation work is inundated under water at the starting stage of the project which is a great disadvantage for the construction companies and disrupts the work.

Table 3: Ranking of Environmental risk

No	Sub- Risk	Mean RI
1	Unhealthy working environment for the workers	6.05
2	Any impact on the environment due to the project	4.2
3	Any adverse impact on project due to climate change	3.95

For the workers, working under the direct sunlight and rain is difficult, so safety clothes are provided in some companies but most of the Bangladeshi companies are not aware about them. Air and noise pollution also render for creating unhealthy environment at project site. Ranking of environmental risk are given in the table 3 and found unhealthy working environment as highest risk factor.

7. Conclusion and Recommendation

Since construction projects involve so many parties and activities, risk associated in this arena is a common and global phenomenon. As a third world country, economic problem in Bangladesh (BD) is very serious issue which directly influence the material prices and labor market. Besides, Bangladesh is mostly dense country and good percentage of people is involved with construction industry. But, this sector are encountered numerous problems to terminate the project successfully. Besides, there is lack of competent expertise and no research has been done to solve the problem that frequently happened in this field. So many public and private construction projects are abandoned due to mismanagement and failure to response the associated risk. This study was conducted with the aim to assess the risk involved in BD construction project. From questionnaire survey, 30 risk factors were found mostly associated with BD construction industry. Then, these factors were categorized into four groups. Research found that financial factors is the most severe followed by managerial, technical and environmental group factors. Regarding individual risk, increase material cost was the top most factors and its risk index (RI) value almost double of the nearest risk factor e.g. increase of labor rate. Other important risk factors were project delay, short time of tendering or

bidding, lack of experience, loss due to fluctuation of construction materials inflation, improper planning and budgeting etc.

To overcome this situation, some recommendations are listed here that will help to ensure successful project in Bangladesh:

1. Risk management should be considered a primary tool to assess the project. From the survey it is understood that risk management is not practiced in most of the companies and if followed, it is not done systematically. Immediate mitigation measure should be in place if a risk event happened.
2. During the planning stage, full scale risk assessment about the project should be made as effective measure to curb risk.
3. Intensive feasibility study should conduct before starting a project.
4. Financial part of the risk is a global phenomena and this risk should be handled carefully using financial consultant since this cannot be handled by engineers alone.
5. Most of the company's management follow Top to Down approach which is a traditional approach, but Down to Top approach should be followed so that the employees voice are heard.
6. Appointment of a risk management consultant in a project would be good option for assessing and managing the risks associated with the project.

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Performance Improvement within Public Sector Construction Framework Agreements

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Abstract

The construction industry has a history of client dissatisfaction. A potential solution for improvement is through use of a framework agreement, where long term relationships between parties may focus upon performance. This research aims to assess whether use of framework agreements can result in significant improvement for performance when compared with engagement of contractors through traditional discrete methods. A single-case study approach is used to investigate outcomes set within the context of a public sector organisation in the UK. Quantitative data compiled from 164 highways related civil engineering projects are separated into two groups – one represents those procured using traditional discrete methods and the other within a framework agreement. Results from t-tests identified significant improvements in overall performance and in time (finish on time), cost (payment accuracy) and quality (defects) resulted from the framework agreements. Conclusions from this study support use of framework agreements within a public sector environment.

Keywords

Construction, frameworks, performance, public sector.

1. Introduction

Criticism of performance with the UK construction industry is not new. Concerns were voiced through two significant government reports – Constructing the Team: Latham (1994) and Rethinking Construction: Egan (1998). Other independently commissioned reports not only reflected six decades of concern with performance and project out turns placed within a public sector context, but also recognised difficulties experienced from suppliers in achieving such goals. A critical review of these reports indicate emergence of two clear areas of perspective. Between 1944 and 1980 the reports recognised central and local government organisations in context as the predominant client for the UK sector (Murray & Langford 2003). Emphasis with standardisation, contractor selection and continuity of work are at a fore in these earlier reports. Post 1980 portrays a changed picture, where government bodies are facilitators of best practice. Furthermore, post 1980 reports seek to elevate the UK construction industry to ‘world class’ and propose adoption of team values towards this goal. The importance of relationships within the team are highlighted in Egan’s Report and emphasised further in *Modernising Construction* (National Audit Office, 2001) together with a call for effective use of investment, training and innovation in projects.

In order to engage with recommendations offered by Latham and Egan, public sector organisations made changes to their supplier selection processes whilst retaining the need to comply with statutory requirements. Public sector frameworks have been developed under EU Directive 2004/18/EC of the European Parliament for coordination of procedures for the award of public works contracts, public supply contracts and public service contracts. This legislation defines frameworks as *'an agreement with suppliers, the purpose of which is to establish the terms governing contracts to be awarded during a given period, particularly in respect of price and quantity'*. Longer term agreements are known by practitioners as strategic frameworks, where objectives of providing stronger relationships through fewer suppliers align with initiatives suggested by Latham (1994) and Egan (1998).

Construction Frameworks are a relatively new idea. Although a number of frameworks have been concluded, there is very little analysis regarding performance outcomes. A 'gap in professional knowledge' has arisen due to the long periods required to compile data and the transient nature of the organisations being measured. Construction projects, by their nature, involve teams being assembled for specific projects which are then disbanded upon completion. The lack of available data was recognised as a hindrance to studying construction industry performance by Dainty (2008).

This research aims to assess, through a study of a framework set against a large stable public sector organisation in the UK, whether use of framework agreements for construction projects can result in significant improvement for performance when compared with engagement of contractors through traditional discrete methods.

2. Nature and benefits of framework agreements

An assumption made by early central government reports is that public sector procurement cannot manage large scale projects as effectively as the private sector because it is not subject to the same market pressures (Construction Excellence, 2009). Evidence placed before the House of Commons (Business and Enterprise Committee, 2008, p20) suggests that *'it is false dichotomy to differentiate between the public and private sectors on their performance as construction clients'*. The committee concluded that a significant influence upon project success is the frequency of use of construction services rather than the sector within which the project is set. Experienced clients, either public or private sector based, are more likely to understand how the construction process operates and realise the critical nature of key decisions at appropriate stages than those clients who use construction services infrequently. Clients that align critical phases of a construction process with their own control systems (for example, internal budgetary approval aligns with tender receipt) will out perform those who do not.

Framework agreements are therefore created between parties with the intention to establish long term collaborative working arrangements. A client may enter into a framework agreement with a single operator or with several operators. The framework agreement provides an 'umbrella' contract with projects separated into individual 'work packages' which have discrete conditions of contract, specification and payment mechanisms.

A prime characteristic of a framework agreement is the term – the pre-determined timescale for operation of the agreement. With public sector agreements, Public

Contracts Regulations 2006, and EU Directive 2004/18/EC of the European Parliament of the Council of 31 March 2004 dictate that the maximum term of a framework agreement shall be four years in duration, unless strong exceptions can be demonstrated. A secondary characteristic of frameworks is that a client may enter into a number of identical agreements with different suppliers effectively creating a selected community within which to deliver projects.

Framework agreements are therefore not intended for single user clients or an individual project. They are designed for use where similar sets of works or services are required of a selected number of suppliers over a period of time. A term of four years allow relationships and understanding to be nurtured where focus can be placed upon overall service rather than individual isolated performance of a project. Although arrangements are permitted between a single client and single supplier, it may be considered that removal of competition may affect outcomes. Most arrangements are therefore between a client (or conjoined clients) and multiple suppliers to allow competitive elements to be incorporated.

A number of perceived benefits are stated to apply through the use of framework agreements (Construction Excellence, 2009). These can be summarised as follows:

- More effective and efficient tendering procedures for clients
- Continuous improvement from engagement of best practice
- A greater depth of understanding between all participants due to longer term relationships
- Ability for suppliers to gain a higher success rate with bidding for projects
- A higher level of commitment for a client due to longer term relationships

Although framework agreements have received support from central government (Business and Enterprise Committee, (2008), p21) they do not have universal acceptance by all stakeholders of the construction process. Such criticisms arise through incorrect application of a framework by a public body or questions of economic effectiveness of frameworks. Concerns with competition due to a smaller number of suppliers have also been expressed through the private sector. Although some private sector organisations pioneered use of framework agreements, pressure on capital budgets due to economic contraction over the last three years has caused re-evaluation of value for money to be undertaken. BAA plc were amongst the first to develop framework arrangements based upon a 'cost plus' model in order to secure commitment and resources for large capital projects. The economic downturn since the financial market collapse in 2008 has challenged strategic views of the effectiveness of this model. BAA's framework arrangements expired during 2009/2010 and were replaced by elements of traditional tendering with a wider list of suppliers effectively mirroring a traditional procurement model (Morgan, 2009). A substantial reduction in government spending for the fiscal year 2011/2012 has also questioned the value of framework agreements for public authorities, both in quantum of transaction and capital costs, with a number of clients reverting to 'lowest bid wins' models.

3. Performance measures

A review of the impact of framework agreements necessitates examination of the development of a construction project in order to identify the most appropriate

period to apply performance evaluation methods. Performance evaluation can be measured at any stage of project delivery, but difficulties occur with methods of measurement and quantification of results until a project reaches sufficient maturity for tangible metrics to be applied. Research into construction management has identified six phases, namely - conception, planning, design, tender, construction and operation (Lim and Mohamed, 1999). Each phase requires efficient execution in order to contribute toward successful delivery of the completed development, but the nature of the phases incorporates distinct dynamism. Resources used for elements of concept, design and planning may be recorded to provide comparative costs or timescales for a project, but variances between projects render such outcomes inherently unreliable. A single external variable at the early stage of a project – for example, a planning delay, causes comparisons to be unrealistic. Controlled phases of a project at later stages where levels of specification, time periods and constraints/extent are known allow parameters to be measured and results quantified. For these reasons construction management research concentrates upon the construction phase as a focal point for examination of performance outcomes (Ahadzie *et al*, 2006).

Project success arises from use of performance measurement to quantify how well an organisation is in attaining objectives (Evangelidizs, 1992). Classification of project success has changed significantly over the last five decades. In the 1960's a project was deemed successful if 'it worked', that is, fulfilled its prime functional objective (Kerzner, 1998). This single descriptor of success was expanded into outcomes of price, quality and cost (Oilsen, 1971). An 'iron triangle' described by Atkinson (1999) was the focus of performance research for a significant period, where if projects fulfilled all three success factors they would be described as extremely successful. Since that date, introduction of other measures has been added to assessment of success according to the environment within which each project sits. Chan *et al* (2002) introduces post completion, stakeholder involvement, operational measures and the like, as other criteria to be considered toward success. The introduction of total quality management systems into construction operations has seen a further expansion towards measurement of classification of project success by use of specific metrics.

Expansion with a range of metrics being suggested to measure project performance together with associated collection has suggested a polarisation toward 'critical success factors' (CSF's) – representing those that matter to particular clients and stakeholders – rather than including a wider range of parameters. Kerzner (2001) suggests a focus back to the 'iron triangle' but adds secondary criteria such as minimising disruption to stakeholders, change to corporate culture and the like. Yeung *et al* (2008) modified this concept further by identifying seven key weighted indices aggregated to produce a single partnering performance index to measure the success of projects. This model is proposed for identification of critical success factors and an aggregated project success index to measure performance of the construction projects included within this research. Construction of an index involved weighted apportionment, where selection of such involved analysis arrived through responses from clients. The model adhered to traditional views of performance to price, time and quality – but introduced four other critical success factors, although with lesser weightings. Validation of the model was achieved through the research, but conclusions recognised the need to change critical success

factors to suit different objectives of a client and varied project situations. With a single index, quantitative comparison between projects can be made.

4. Hypotheses and research methodology

It was hypothesized that framework agreements can have a positive impact on time, cost and quality at the construction phase, covering mobilization and works, due to long term relationships. These are the three critical factors measuring project success and they should be further defined by individual clients to reflect their objectives for specific projects.

The chosen methodology for this research aligns with access to available data, a reliable and consistent organisation and a sociological group of participants with experience of construction frameworks. In order to collect data using the effects of a framework agreement within an organisation, a single-case study approach was selected to quantitatively examine the impact of framework approach on project performance. The organisation chosen is a significant local government public sector authority regulated by statutory legislation applicable to all similar UK authorities. Consequently, the research findings will have implications for other authorities.

Fellows and Liu (2008) and Yin (2009) both state that case study research can be used to investigate phenomenon within real context and can therefore draw rich conclusions. Yin (2009) further contends that findings from single-case study are useful to build up a theory. The theory can then become a vehicle for examining other cases. Consequently, the single-case approach can make significant contribution to knowledge. As compared with possible qualitative interview or questionnaire survey, quantitative study can provide an objective analysis on the impact of framework agreements on time, cost and quality. A quantitative approach was therefore chosen for this study.

Data was collected over a period of four years (2006 – 2010) from projects contained within a certain technical class – that of highways infrastructure. Identification of critical success factors for the client was obtained through documentary evidence from the organisation and with group meetings of senior officers where weightings were calculated for project outcomes. The organisation ‘takes for granted’ that projects will be delivered to required time scales, in accordance with budget provisions and to the required specification and therefore critical success factors form an additional supporting role to contractual requirements by encouraging overall project delivery. The five factors are identified in Table 1.

The critical success factors in Table 1 may be considered an extension of the ‘iron triangle’ of costs, time and quality because CSF1A and 1B are time related, CSF2 is cost related and CSF3/4 are indicative of performance during and at completion of a project. Although specific to this research, the CSF weightings are of a similar proportion to those conducted with previous studies (Yeung, *et al*, (2008).

Two batches of project data which represented differing procurement and contractual engagement processes were examined. Group 1 comprised aggregated data from 60 discretely procured civil engineering highways related projects collected between 2006 and 2008. Group 2 uses aggregated data from 104 civil engineering highways related projects collected between 2008 and 2010 through a

framework agreement with a performance incentive mechanism. Both groups have the same public sector client controlled by standing orders, NEC 3rd Edition conditions of contract and same specifications. Two analytical methods were applied:

- Descriptive statistics from data for both groups
- Independent-samples t-test analysis for differences between the groups

Table 1: Critical success factors identified by the client organisation

Number	Critical success factor	Weighting	Description of Metric
1A	Ratio of start on time	0.165	Ratio of days late starting against contract period
1B	Ratio of finish on time	0.165	Ratio of days finished late against contract period
2	Ratio of accuracy of payments	0.270	Interim payments certified within 5% of suppliers application
3	Right first time (defects)	0.200	Projects completed without remedial works – yes score = 1, no score = 0
4	Health and safety inspections	0.200	Percentage of inspections passed

5. Results and discussion

5.1 Descriptive statistics from discrete and framework projects

Section 1 of Table 2 compares the percentage of projects finished on time with those finished late. A contrast with results from 36 number highways projects undertaken by Graves and Rowe (1999, p11) under the *Agile Construction Initiative* showed that only 30% of projects within that specialist area were completed within contractual time scales. Discrete projects contained within this research (highways related civil engineering related) only achieved a completion success of 12% within or at contractual time scales with framework projects having a 64% success rate using the same measure.

Two further areas of initial examination followed. Discrete projects started as required on 53% of occasions, whereas framework projects achieved this with 82% of the case study results (Section 2 of table 2). Comparable published data has not been found that aligns with the case study results. Section 3 of table 2 concerns defects at completion of a project. A study undertaken by the Building Economic Development Committee (1974, p23) using data received for office building projects found that 46% of projects had some form of defect at completion. Discrete projects within this case study produce similar results, as 38% recorded a defect at completion. By comparison those projects undertaken within framework agreements produced a reduced 10% failure rate.

Table 2: Headline analysis of comparative results

Section 1 Source	Projects finished early or on time	Projects finished late
Agile Construction (Graves and Rowe 1999)	30%	70%
Case study discreet projects	12%	88%
Case study framework projects	64%	36%
Section 2 Source	Projects started on time	Projects started late
Case study discreet projects	53%	47%
Case study framework projects	82%	18%
Section 3 Source	Projects finished with defects	Projects finished without defects
BEDC (1974) office buildings	46%	54%
Case study discreet projects	38%	62%
Case study framework projects	10%	90%

Results from the raw data showing outcomes of projects have been further synthesised into five critical success factors stated in Table 1. Project outcomes for each critical success factor are calculated as numerical values in accordance with specific defined parameters using the metrics in Table 1. These values range from 0 (total failure in performance) to 1 (full performance of the metric). Each performance value is multiplied by the weighting decided by the client in Table 1 to arrive at a critical success value (CSF) for each element. Measurement of critical success factors (independent variables) allows aggregation of a project success index (PSI, dependant variable) to be displayed as a numerical value between 0 and 1.

PSI was calculated based on the single performance index model to measure the success of projects, as developed by Yeung et al (2008) in an empirical study for civil engineering projects in Hong Kong. The model is shown below.

$$\text{Project success index} = \sum \frac{(AS - MV)}{(SV - MV)} We$$

Where:

Project success index = measure of success of a project

AS = Actual Score of the critical success factor being measured in accordance with the measurement definitions

MV = Minimum percentage value of the critical success factor

SV = Stretching percentage value of the critical success factor

We = Weighting of the critical success factor

Any negative integers are valued at zero

Resultant CSFs and PSIs for all 164 projects are shown in Table 3. Application of group statistics show arithmetic means, standard deviation and standard errors of the two groups for each CSF and PSI.

Table 3: Group statistics for all 164 projects

Group Statistics					
	Discrete or framework project	N	Mean	Std. Deviation	Std. Error Mean
CSF1A result	Discrete project	60	.158	.014	.001
	Framework project	104	.160	.013	.001
CSF1B result	Discrete project	60	.129	.047	.006
	Framework project	104	.144	.040	.004
CSF2 result	Discrete project	60	.107	.054	.006
	Framework project	104	.250	.038	.003
CSF3 result	Discrete project	60	.123	.098	.012
	Framework project	104	.180	.059	.005
CSF4 result	Discrete project	60	.158	.044	.005
	Framework project	104	.187	.041	.004
Project success index	Discrete project	60	.677	.149	.019
	Framework project	104	.924	.092	.009

Table 4: Summary of independent samples t test results and interpretation

Variable/factor	Independent test result	t-p-value	Levene's squared value	Eta squared value	Cohen's magnitude of difference between means of the groups
CSF1A – starting on time	0.278		0.007		Very small
CSF1B – finishing on time	0.034		0.027		Small to moderate
CSF2 – Accuracy of payments	0.000		0.709		Large
CSF3 – right first time (defects)	0.000		0.095		Moderate to large
CSF4 – Health and safety	0.000		0.090		Moderate to large
PSI – Project Success Index	0.000		0.454		Large

In order to statistically explore whether the two groups performance significantly different, a third method of analysis was employed. Independent-samples t-tests were used to detect the variation of means between the two groups and interpreted

using Levene's (1960) test of equality using an Eta squared formula. The following characteristics were applied:

- Dependant variables measured at interval levels using continuous results.
- Projects represented all of the population of highways infrastructure schemes undertaken by the organisation between May 2006 and December 2010.
- Observations were independent and supported by independent evidence. No interaction existed between the five critical success factors.

Results are interpreted using guidelines proposed by Cohen (1998) to determine the magnitude of difference between groups. 0.01 infers small effect, 0.06 for moderate effect and 0.14 for large effect. A summary of results is shown in Table 4.

5.2 Independent-samples t-test analysis of the groups

Results from the t-tests indicated a significant difference between the submission and agreement of accounts between supplier and supervising engineer. Although contractual payment mechanisms for both groups are the same, measurement of accuracy of payments (CFS2, p-value=0.0005) within a framework environment increases the performance with cost prediction. Other significant relationships related to quality improvement with framework projects. Defects and health and safety metrics (CSF3 and CSF4, both p-value=0.0005) were significantly higher with this group when compared with discrete projects. The reduction in defects was also reflected through descriptive statistics at Table 2. Mean scores for the two groups concerning starting on time (CSF1A, p-value=0.278) was insignificant and finishing on time (CSF1B, p-value=0.034) was significant according to t-test results. This infers that more stringent contract requirements and performance monitoring should be put in place to ensure contractors to start on time.

The aggregated measure of performance between groups was significantly different as the mean PSI score for framework agreement projects was 0.924 compared with 0.677 for discrete projects, as supported by the p-value (0005). The eta squared statistic was 0.454 and the magnitude of difference was large. As explained by Construction Excellence (2009), construction clients have a high level of commitment from the contractors due to longer term relationships and better success rate with bidding, which results in continuous improvement from engagement of best practice, a greater depth of understanding between all participants, earlier involvement of contractors and most importantly collaborative working. These arguments have been previously advocated by Latham (1994) and Egan (1998). In summary, the hypothesis that framework agreements can have a positive impact on time, cost and quality at the construction phase due to long term relationship was validated.

6. Conclusions

Results from examination of the raw project out turn data for the 164 highways related infrastructure projects show a significant performance improvement with framework projects when compared with those undertaken using discrete methods, in terms of aggregate performance as well as individual performance in time (finishing on time), cost (payment accuracy) and quality (defects). Consequently, use of framework agreements should be supported. More stringent contract

requirements and performance monitoring should be put in place to ensure contractors to start on time.

A significant magnitude of difference in performance would suggest a phenomenological effect between the two groups. As contractual and operational controls systems for both groups are the same, an explanation of the cause of such improvement is through effect of team working with longer term relationships available to participants in a framework agreement, as suggested by Latham (1994) and Egan (1998). Further investigation should be undertaken through additional case study research to confirm such causation.

In addition to this, further research should be done to examine the impact of framework approach on production and transaction costs. With performance and cost implications, the client will be able to determine whether framework agreements are a more cost effective procurement route. Finally further studies should be conducted to test the validity of both performance and cost findings in other public sector settings, thus enabling more robust comparison results to enable public sector clients to make an informed decision on the choice between framework and traditional approaches.

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The Role of Organizational Culture in Managing the Knowledge in the Information Communication Technology Small Firms in Libya

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Abstract

Since over 25 years, the influence of embedding the culture of managing the knowledge in the business organization started to be questioned. The concern about the value of knowledge started to rise as many studies found that managing knowledge is a main key to achieve better performance as knowledge has been seen as crucial to the companies' competitive advantages. The purpose of this paper is to examine the role of organizational culture in managing the knowledge in the small information communication technology (ICT) firms. The authors set the study in the context of Libya as a developing country aiming to contribute to the literature with findings which will emerge from an interesting context considering the uncommon circumstances the country is experiencing after the Libyan revaluation (pre- and post AL-Qaddafi Dictatorship)

Keywords

Developing countries, Information and communication technology industry, Knowledge management, Libya, Organizational culture.

Introduction

The ideas related to the role of the organizational culture in managing and enabling sharing knowledge in the information and communication technology (ICT) small firms in Libya are addressed in this paper. Studying the influences of organizational culture on sharing knowledge in the small firms in Libya as developing country has the potential to contribute to the literature with interesting findings, due to the circumstances surrounded the context since over 40 years and to the changes acquired since the Libyan Revaluation 2011. Chorev and Anderson (2006B) saw that the organizational culture should be embedded in the small ICT firms to drive sharing knowledge in order to increase the competitive advantage and stability especially with their limited resources. Sharing and managing knowledge issues were addressed in Davenport (2005) who noted that research studies in the small firms' contexts are still limited. Furthermore although ICT as a tool has been the focus of extensive academic papers, studying the influence of organizational culture on sharing and managing knowledge within the context of the companies which provide the ICT tools are still limited (Parirokh et al., 2008). The authors are interested in providing their perspectives based on their theoretical understandings to issues related to possible influences of organizational culture and managing and sharing knowledge in small firms that provide ICT bearing in mind that this business is driving this edge of knowledge economy (McQuaid, 2002).

Information and communication technology industry: context

According to González et al (2012) ICT firms can be divided into the following sub-sector categories, based on the service they provide:

- Components/hardware firms: conduct mainly activities related to the design, manufacture, assembly and/or sale of ICT hardware (for computers, telephones, network devices, etc).
- Software products firms: conduct mainly activities related to the creation and sale of relatively standardized software applications and tools, which may be designed to be used by organizations operating in specific sectors of the economy (“vertical” applications), by a wide variety of organizations (“horizontal” applications), or by individuals.
- ICT-enabled services (ITES) firms: that provide services which are not necessarily directly related to ICT services and products (such as “business processes outsourcing”) but whose delivery to clients is enabled by telecommunication and computer networks (González, 2012).

For the context of this study which is Libya all three types will be presented, however the constriction will be on the small firms due to the following facts 1) Libya before 2011 Revolution was controlled in all terms by AL –Gaddafi’s Dictatorship who prevented many multinationals and big bands name firms from investing in Libya which made the establishment of such firms is hardly seen. 2) After the Revolution and due to unsettle states in terms of safety and security big information and communication technology bands and multinationals firms did not start yet their business although the possibilities are promising and 3) accessing and collecting information from small firms which are common in Libyan’s context makes this study applicable in turn the results which will emerge can have a significant influence on the in running firms in the sector bearing in mind that the new government in Libya supports the growth of such business . In addition that ICT firms were selected because such type of firms must continuously innovate and develop in order to maintain its competitive position and stability in the rapidly changed market .So the focus of this study will be on locally owned and operated small ICT firms (domestic firms), not on multinationals. Multinational firms are excluded from consideration in this study for the reasons mentioned earlier.

Information and communication technology industry: significance in Libya

Information and communication technology industry is one of the most high-tech industries worldwide due to its great contribution to the global development. Schreyer (2000) argued that information and communication technology business firms have a significant contribution on the economic growth and it has important role in labouring thousands and thousands of employees and they were able to support the development of multi-factor productivity. Santangelo (2000) noticeably named the ICT industry as leading sector because the number of strategic technological partnerships (STPs) which has been recorded in the science based fields. Schreyer and Colecchia (2001) argued that ICT industry contributed between 0.2% and 0.5% per year to economic growth, depending on the country bearing in mind that their study covered the output growth in Australia, Canada, Finland, France Germany, Italy, Japan, the United Kingdom, and the United States.

Moreover only during the second half of the 1990s, this contribution increased to 0.3% to 0.9 % per year. Regardless of the variations between countries, ICT industry plays a key role in developing the economies of all the studied countries bearing in mind that improving the performance in the industry depends mainly on applying the right business strategy.

In addition, infoDev (2008) saw that the development of well established ICT industry in developing countries is usually associated with well-built government initiatives based on the recognition of the sector as being of special strategic importance. The government-backed and -funded development of large technology parks oriented towards software and other ICT-related areas, with substantial representation of domestic businesses, has been vital in the development of ICT sectors in large and small Asian countries. In the Libyan context, however, there is only one recent study carried out by Sassi (2008) who observed that the existing relation between the authority and the government and the authority and the telecommunication companies was not motivating any private sector to invest in the Libyan telecommunication market. However and after 2011 revaluation which breakdown AL –gaddafi’s Dictatorship no more studies were carried out to highlight the contribution of this business to the country development, thereby; this study has the potential to bridge this gap.

Information and communication technology industry: performance

According to Pemberton and Stonehouse (2000) ICT firm’s performance relay heavily on the experts’ productivity and innovation. Drucker (1995) rightfully predicted knowledge has become a key economic resource and a dominant source of competitive advantage. In addition, Chong and Choi (2005) stressed that ICT firms are just like other firms were influenced by the globalization and the growth of ICT implementation. They argued that most of ICT firms have moved since early 1990s from information age to knowledge age which required from them changing their strategies and shift their focus to the value of intellectual capital rather than common resources to acquire better performance and stability. So the question whether ICT firms are required to improve their performances in the age of knowledge can be found in the report published by iSociety (2012) which was titled by UK technology is not working stressed that among all types of firms to avoid the low –tech equilibrium “Suppliers and buyers should encourage each other to think organizationally and culturally not just technologically when talking about ICT” which implicitly include ICT firms. (Amat Tapp, 2001) stressed that to avoid disappointing in facilitating their knowledge ICT firms should manage their experts’ knowledge to be able to provide better performance. In addition, (Chesbrough and Appleyard, 2007; Bigliardi and Dormio, 2009) argued that nowadays, it is widely recognized that companies, regardless the industry they are belong to, and in order to increase the perceived value of their services as well as to expand their competitive areas, are forced to manage their knowledge and provide innovation that involve the business strategy. In the Libyan’s context Sassi (2008) saw that few problems monopoly over the ICT Libyan’s market those were: 1) low rates in the fixed line and internet market, 2) High services’ prices, 3) low quality services, 4) lack of clear policies, and 5) lack of job’s vacancies. Since his study, no more studies were carried out to examine the performance of the ICT firms in Libya which increase the significant of this study.

KM influence on the business organizational performance

Since the globalization shifted the business organization economy from production-based to knowledge based economy, many business organizations started to realize the value of KM to manage their intellectual values. Regardless the sad stories of many organizations which conceived KM as ICT tools that enable learning organization and more sharing, KM in practice became one of the most powerful business strategies to achieve better productivity and high competitive advantages (Chong and Choi, 2005). Choi (2000) stated that knowledge and its management has been bonded to organizational performance and strategy dating back in 1982. Nevertheless, the “bone” between KM and organizational performance has become even more critical as the business organizations moved into the era of k-economy.

Liebowitz and Suen (2000) stressed that the most valuable organizational resources is the knowledge existed in the minds of the firm’s members. Quinn et al (1996) argued that if KM is a critical determinant to an organisation’s success, then it is very significant that an efficient knowledge-intensive process must be established to meet the demands of improved firm’s performance.

In addition, and accordingly Liebowitz and Suen (2000) decision makers of successful organizations and nations are paving the ways to create and generate value from knowledge assets within their organization because knowledge and learning are essential to obtaining and sustaining a competitive advantage in today’s business environment. Then he added that KM can be the main key to organize different activities conducted by the firms to increase their stability and performance. Rowley (2000) added that only those organizations that can identify, value, create and evolve their knowledge management strategy successfully will be able to perform better in the global information society. Accordingly, Marr (2003) saw that the only reason prevents business organization from adopting KM is a lack of understanding of KM benefits, including a narrow focus on it and its relations to performance outcomes.

Many scholars such as Bassi (1997); Chong (2006b); Chong et al., (2006b); and Sharmillah Devi et al., (2007b) stressed that KM has a significant beneficial to ICT organizations in various ways such as its ability to improve performance , productivity and competitiveness, decision making process , responsiveness, innovation, quality of the services and products , learning curve , employee retention, flexibility ,and cost efficiency.

But many others such as Swan and Scarbrough (2001) argued that many ICT business organization fail to improve their performance and competition position after adopting KM strategies because the embedded organizational culture did not accept the changes that KM initiatives brought to the organization.

Noticeably in the Libyan context, Khalifa and Jamaluddin (2012) assessed in their study the main factors that affect the implementation of KM in construction industry in Libya. They identified few challenges which can influence knowledge sharing and implementation of KM such as the steadily increasing speed with which new technologies are evolving. In addition and based on the findings of their study, they created a model of a key success factors were top management support and knowledge sharing have significant predictors of knowledge management implementation. Harmonizing with their findings, this study aims to explore the role

of organizational culture on managing and sharing knowledge in different industry which is the ICT within the same Libyan context.

The role of organizational culture as enabler or barrier in managing knowledge in the ICT small firms

According to Deal and Kennedy (1982) saw that culture is the most important signal to assess the success or the failure in organizations. They recognized four main key dimensions of culture those are:

- Values including the beliefs which live at the heart of the organization and culture Heroes who are the people who hold values.
- Rites and rituals which include interaction routines that have representative qualities.
- The culture network which includes information communication system and invisible hierarchy of power in the organization.

In the other hand De Long and Fahey (2000) argued that traditional organizational cultures and systems can have factors that cause serious barriers toward completing a successful KM in the ICT firms. They saw that organizational culture has a significant influence on behaviors interest in knowledge creation, knowledge sharing and using. They added that most business organizations are lack of the culture that encourage collaborative work because employees believed that personal ownership of knowledge will help them ensure job security so they concluded that lack of sharing knowledge can be a serious barrier which might cause KM failure.

Moreover, Jassawalla and Sashittal (2002) argued that organization can achieve high level of product –innovation settings when it is able to learn how to develop the features of highly innovating supportive culture. Moreover Lin and Lee (2004) stressed that the level of encouragement provided by senior managers influenced on distributing the culture of knowledge sharing. They added that senior manager's attitudes, subjective norms and perceived behavioral control had a positive influence on intentions to encourage knowledge distributing and sharing. Moreover Ruppel and Harrington (2001) saw that the management should ensure that the accurate values are in place to optimize intranet implementation and facilitate knowledge sharing.

In the same context, Ogbonna and Harris (2000) thought that the most significant reason that make a specific organizational culture enabler of successful KM implementation is the ability of that culture to lead to advanced organizational financial performance. Krefting and Frost (1985) argued that organizational culture can enable better competitive advantage only when it is able to identify the boundaries of the organization in a manner which facilitates individual interaction and/or by limiting the scope of knowledge sharing to appropriate levels bearing in mind that individuals are the key component to knowledge management activities; hence the type of culture existing in the firm is very crucial to knowledge management activities.

Finally, Ron (1997), HO (1993) and Chang (1995) identified different key success factors (KSF) for managing knowledge in IT consulting companies those factors are summarized in the table 1.

Table 1: key success factors for managing knowledge

Ron	Ho	Chang
Knowledge of consulting field	Professional consultant's knowledge	Know-how experience
Time for research and examinations	Quality of consulting service	Quality control of the service
Ability of listing, surveying, sharing and analyzing	The company reputation	Well established public relationship
Feeling	Mastering of public relationships	Innovation capability

As it can be seen from the table (1) most of the addressed factors correspond to organizational culture as well as to the successful implementing of KM in the IT firms. Thereby if the ICT firms and business organizations failed to embed the organizational culture that enables them accomplish those factors or at least combine between few of them, then the failure will be the future of the implemented knowledge management strategy. In the Libyan literature and its related issues, there is no recent study examine the role of the organizational culture in the ICT firms which is one of the main contribution of this study.

Outcomes of previous studies similar to the context of this study

Alawi and Al-Marzooqi (2007) investigated the influence of organizational culture on knowledge sharing. They used the survey as a tool to collect their data and they targeted public and private companies in Bahrain. The survey's outcome showed a positive correspondence between knowledge sharing and trust, communication, information systems, and rewards.

In the same context Marouf (2007) examined the influence of business and social ties on knowledge sharing in an international firm. His study was able to show a considerable correspondence between the strength of business ties and sharing of both public and private knowledge.

Year later , Boumarafi and Jabnoun (2008) found a positive correspondence between measures of performance improvement and several KM dimensions presented in Al-Busaidi and Olfman's (2005) study.

Later, El Harbi et al., (2011) carried out a study to examine knowledge sharing processes in Tunisian small ICT firms. Their findings approved that information and knowledge are vital keys to achieve high operational success in such companies considering that knowledge and its different application played an important role in motivating better competitive advantages. They were able to highlight the positive role of managers in running and developing useful internal systems for sharing information as well as efficient methods for motivating existing external knowledge. However, evidence was also found of immature national information sharing systems. The researchers reflected this to the level of development in Tunisia and to the understandable attitudes of the firm owners.

A very recent study is carried out by Al-Adaileh and Al-Atawi (2011). They aimed to investigate the impacts of national local culture on knowledge exchange in Saudi Arabia and to achieve this aim they used data from Saudi Telecom Company (STC)

and they examined the role of cultural attributes on knowledge exchange processes within the STC. The study found that cultural attributes of trust, innovation flow, supervision, and reward have serious positive influences on knowledge exchange within STC context. Accordingly, this study will build up based on the previous studies aiming to contribute with potential interesting findings acquired from uncommon interesting context.

Conclusion

To sum up, organizational culture plays a vital role in managing and enabling sharing knowledge in business organizations regardless their context and types. ICT small firms context have not been widely investigated in the current KM literature. In addition, the liberated Libya, which experienced one of the very unusual circumstances, was not subject to investigation concerning sharing knowledge and organizational culture. Hence, investigating the influences of organizational culture on sharing knowledge in the small firms in Libya as developing country has the potential to contribute to the universal conversation in the organizational culture, managing knowledge and sharing knowledge with interesting findings.

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The Effective Management of Remote Projects: Lessons from Other Jurisdictions for the Scottish Highlands and Islands

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Abstract

Commodities extraction and energy production projects are increasingly sited in remote, challenging and environmentally sensitive locations. The poor performance of many of these projects highlights a need for more effective design, risk and project management strategies. A preliminary literature review discussing the work of a number of key authors in the field. The need for further research to develop more appropriate definitions of 'remote', and the rural built environment for the Highlands and Islands, explore the extent of the negative human aspects of remote project working and improve inter-disciplinary risk management practices. The next 20 years will see inward investment of over £100 billion in energy production projects in the north of Scotland. This paper considers the established literature within the specific context of the Highlands and Islands where the majority of these projects will be based.

Keywords

Remote construction projects, risk management, Scottish Highlands and Islands

Introduction

Whilst writers, artists and travellers have always been drawn to the remotest parts of the world it is only recently that industry and governments have turned their attention to the commercial possibilities of Europe's sub-arctic and Atlantic fringe; in particular, the potential for commodities extraction and energy production (Emmerson, 2010; Wheeler, 2009).

10% of the world's oil and 25% of its gas is already produced in the arctic and sub-arctic (Arctic Monitoring and Assessment Programme, 2007). At the edge of the sub-arctic and on Europe's western edge Scotland has estimated oil reserves of 2 billion tonnes, gas reserves of 1330 billion cubic metres (Scottish Development International, 2011) and a quarter of Europe's tidal and off-shore wind potential (Scottish Government, 2011). Much of the work to exploit these reserves will take place in the Highlands and Islands: one company alone, Scottish and Southern Electric (SSE), estimates that it will invest up to £10 billion in this part of northern Scotland over the next ten years (University of the Highlands and Islands, 2012).

As energy and commodities prices rise in response to increased demand from a growing and increasingly urbanised world population, projects previously judged to be technically unfeasible or prohibitively expensive are receiving renewed attention. However, the recent performance of remote projects is distinctly uneven; the Deep

Water Horizon spill illustrated the difficulties of effecting repairs to remotely located equipment; the Liquid Natural Gas plant at Melkoya in northern Norway has closed four times for major repairs and element replacements since its opening in 2007 (Hydrocarbons Technology, 2012); plans for the construction of an aluminium smelting plant at Bakki in northern Iceland were recently abandoned after five years of project planning and environmental impact assessment (Alcoa, 2011) and, in Scotland, the largest hydro-electric scheme constructed for fifty years, at Glendoe above Loch Ness, closed in 2009 after less than eight months in operation following massive rockfalls into the inlet tunnels; remedial works are estimated to have cost in the region of £20M and took 18 months to complete.

It seems timely, therefore, to examine the particular features - aside from simply logistics - of remote project working. Whilst Scottish engineers and builders have a long tradition of the design and construction of projects in remote and challenging environments – examples such as the lighthouses at the Bell Rock and Muckle Flugga were considered to the engineering wonders of their age - the last forty years have seen a considerable expansion of such work, meaning that the Scottish construction and oil and gas industries can justifiably claim expertise in this area. Remote projects currently form a small proportion of overall UK construction work, but may attain a much higher profile within the construction industry of an independent or more highly devolved Scotland in the future. In a world in which greater proportions of energy and commodities are sourced from remote locations, is there potential for Scottish firms to utilise their existing skills and expertise to enter new overseas markets? Furthermore, can the risk management strategies already developed by Scottish contractors and consultants be further improved to give these firms a commercial advantage in energy projects outwith the United Kingdom (Jones, 2012)?

Little published policy or professional guidance in this field exists and most academic research originates in the southern hemisphere, particularly in Australia, where large-scale extraction projects have developed in remote regions of the country over the last 40 years.

What follows is a preliminary literature review exploring definitions of remote, the rural built environment and landscapes of the Highlands and Islands, the human aspects of remote project working and the design and risk management of these projects; future research work is also outlined.

Definitions of ‘remote’, rural landscapes and the rural built environment

In order to effectively and sensitively manage these projects there must be a clear understanding of whether, and to what extent, a project is remote and of the nature of the environment in which it is sited. This latter factor is particularly problematic in the Scottish Highlands and Islands where contrasting interpretations of the rural environment compete to influence both development decisions (whether or not to build) and subsequent approaches to design and project management (how to build).

‘Remote projects’

For many authors, the terms “remote” and “remote projects” are self-explanatory (Sidawi, 2012; McAnulty and Baroudi, 2010). Unlike Scotland, several countries in the southern hemisphere have policy definitions of remote, for example the Accessibility / Remote Index of Australia (ARIA), which classifies localities as “remote” (“very restricted accessibility of goods, services and opportunities for

social interaction”) and “very remote” (“very little accessibility of goods, services and opportunities for social interaction”) [Commonwealth of Australia, 2001]. Changes in population distributions in Australia over the last hundred years, in essence a general move from rural to city and coastal locations with some increases (but with significant turnovers) in remote communities in areas of mineral extraction and tourist development are rendering these definitions increasingly outdated (Haslam McKenzie, 2007). Perhaps, because of the difficulties with these policy definitions, some authors have developed their own typologies and descriptions of remote.

In their discussion of the characteristics of remote sites Kestle *et al* (2002) define remoteness as a “*continuum related to the physical distance of participants to the site*” (Kestle *et al*, 2002, p307) and define three broad categories - those where all the project participants are initially remote from the project, those where some of the participants are initially remote from the site and those where a few of the project participants are initially remote from the site. On this basis, the majority of construction projects are, of course, to some degree remote and the authors offer further defining characteristics of remote sites in terms of difficulty of physical access, distances from the site of logistical and material support, hostility of the environment and environmental sensitivity.

Both the ARIA and Kestle *et al*’s definitions offer useful starting points for the development of a definition of remote for the Scottish Highlands and Islands – Australia, New Zealand (where Kestle’s work originates) and Scotland are all relatively large land masses with small populations concentrated in cities and along a coastal fringe. However, a major difference between Scotland and Australia / New Zealand is the presence of relatively large communities on offshore islands such as Orkney and Shetland which are important for the construction, maintenance and servicing of oil, gas and renewables installations. Additionally, fully off-shore projects such as oil and gas terminals and wind, wave and tidal platforms can also be considered “remote projects” and all are currently more dominant in the Scottish context. For these reasons, therefore, a further definition of “remote” for Scotland which takes greater cognisance of access issues should be developed.

The landscapes and the rural built environment of the Scottish Highlands and Islands

“The Built Environment as a whole is an enormous subject that in many ways defies definition. There are so many variables that have to be considered.”

(Gray, 2005)

“Purely from a landscape point of view it is worth noting that some landscapes are capable of accommodating larger (wind) turbines better than other landscapes.”

(Van Grieken, 2012)

As in other parts of the UK there is much public debate in the Highlands and Islands about the benefits and costs the development of future energy production projects might bring to an area. This debate - often characterised as “incomers versus locals” with local people seemingly approving of projects that bring with them job opportunities and economic development and markedly less enthusiasm from more recently arrived residents opposed to a perceived industrialisation of the landscape

(Lusher, 2005) – hinges on very different interpretations of the rural landscape and built environment.

For some, the Scottish Highlands and Islands are Western Europe’s last wilderness (Tait, 2009); for others, this wilderness is, in fact, a “human wasteland”, a historical construct arising from the widespread evictions, emigrations and changes in farming practices of the eighteenth and nineteenth centuries (Noble, 2011). In this debate the interpretation of a landscape as wilderness is not always directly proportionate to its remoteness; there are some very remote parts of the Highlands and Islands, for example Orkney, which have embraced the development of both oil and gas extraction and large scale renewables and which are, at the same time, areas whose landscapes are very distinctly man-made. It would be interesting to explore whether Orcadians’ perception of their environment as ‘built’ has inclined them to be more receptive to energy developments. A further complicating aspect is the fact that the Highlands and Islands contain a number of distinct communities with different cultural and linguistic histories. Indeed, other authors have cited the need to develop a typology of the landscape which takes account of the particular cultural and ecological history of the Highlands and Islands (Fisher *et al*, 2010).

Existing typologies of the remote Scottish environment tend to focus on landscapes rather than the rural built environment. As an example, a typology of ‘wild landscapes’ published by Fisher *et al* in 2010 is shown below in Table 1. The theoretical positioning of two landscapes (Mar Lodge and Ben Lawers NNR) against the four axes (remoteness, perceived naturalness, degree of human artefacts and scale) are illustrated in Figure 1 below.

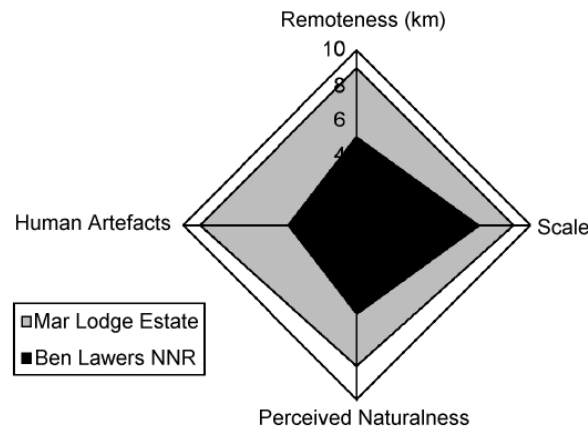
Table 1 : Criteria for typology of wild landscapes (Fisher *et al*, 2010, p17)

Criteria / Axes	Definition
Remoteness	Distance from settlements and roads
Perceived naturalness	Of vegetation, land use and wildlife
Degree of human artefacts	Infrastructures, fencing, erosion
Scale	Area sufficient to provide physical challenge, striking topography or rugged terrain

Table 2 : Landscape types (from Fisher *et al*, 2010, p18)

Category	Description	Definition	Size
1A	Prime core wild landscape (“ideal”)	High in all four axes*	> 2,000 ha
1B	Compromised core wild landscape	Remote, compromised naturalness or may have some human artefacts	> 2,000 ha
2A	Landscape with wild character	Wild character compromised in one, or more likely, two axes	< 2,000 ha
2B	Landscape with wild character	Wild character compromised in at least two axes	< 2,000 ha (smaller than 2A)

Figure 1 : The theoretical positioning of two landscapes (Mar Lodge and Ben Lawers NNR) on a proposed grid of wild character (from Fisher *et al*, 2010, p 17)



From Table 1 and Figure 1 above four landscape types were then derived. These landscape types are shown below in table 2.

* This would seem to suggest that Category 1A landscapes (“Prime core wild landscapes”) should score highly in the Human Artefacts axis (i.e. many human artefacts present). This appears to contradict the typology and the thrust of the authors’ arguments.

Existing definitions of the built environment tend to focus on metropolitan or suburban locations and are either policy-based (e.g. Health Canada, 1997) or describe the built environment functions within a higher education context (Griffiths, 2004); few take account of the user’s meanings of the term (Rappaport, 1982). Knox talks about the “social meaning of the built environment” – the physical reflection of a society’s zeitgeist (Knox, 2010, p202-203) – but what does this mean for the remote built environments of the Scottish Highlands and Islands?

In a paper investigating the links between planning and public health Handy *et al* define the built environment as “(urban) design, land use, and the transportation system, and encompassing patterns of human activity within the physical environment. The built environment is constantly changing in countless ways; some changes are fast (e.g. the drop in pedestrians on a downtown street from noon to midnight) and some are slow (e.g. the deterioration of building exteriors over decades or more” (Handy *et al*, 2002, p 65).

In this definition, a built environment is always a dynamic proposition and this is a particularly useful concept in a Scottish context where little land is “pristine” (a common criteria for wilderness in other countries), but is a human-adapted landscape with these adaptations taking place over many different pre-historic and historic phases. Handy *et al* offer a further measure of their dynamic built environment (Handy *et al*, 2002, p 66) which might be useful for the development of a typology.

Whilst Fisher *et al*’s work is to be welcomed and defines the rural built environment both in terms of what it is not (wilderness) and how it appears at its margins, evidence from recent planning applications shows that developers have few plans to initiate projects in either National Parks or National Scenic Areas (Van Grieken, 2012), the wild landscapes of Fisher *et al*’s typology. Almost all committed and

projected development focuses on areas which might reasonably be perceived to be part of the rural built environment. For this reason, an attempt to generate and validate a comprehensive, culturally-sensitive typology of the rural environment (both landscape and built environment) of the Scottish Highlands and Islands - perhaps by synthesising this work with the work of others such as Handy *et al* - would be a valuable addition to the published literature. Without it there is a risk that an informal or subjective typology will continue to inform the values influencing the design, risk and project management strategies of clients and contractors; or that developers will attempt to circumvent these considerations by, for example, proposing areas of highly concentrated renewables development within the Highlands and Islands (Van Grieken, 2012), perhaps leading to the very urbanisation of part of the landscape most people fear.

The risk management of remote projects

There is very little published policy or professional guidance for the risk management of remote projects. A project's remoteness is not, in itself, a criterion for complexity (Chartered Institute of Building, 2011) although, of course, other aspects of a remote project may give rise to a definition of complex, for example, "construction work accompanied by work of a civil engineering nature" (Chartered Institute of Building, 2011, p 6).

Structured interviews with construction project managers from the Scottish Highlands and Islands (Hayes, 2012) suggest that remote projects often involve particular geological and environmental risks. Whilst the identification of remote geologies can be straightforward there is usually little knowledge available as to how the geology will react to being worked (constructed upon, piled through, tunnelled etc.) or to the action of water upon it. The value of the documented evidence and tacit knowledge of the "worked" geologies of urban environments cannot be overestimated and the unsatisfactory outcomes of many recent remote projects highlight the need for more effective risk management strategies in this area.

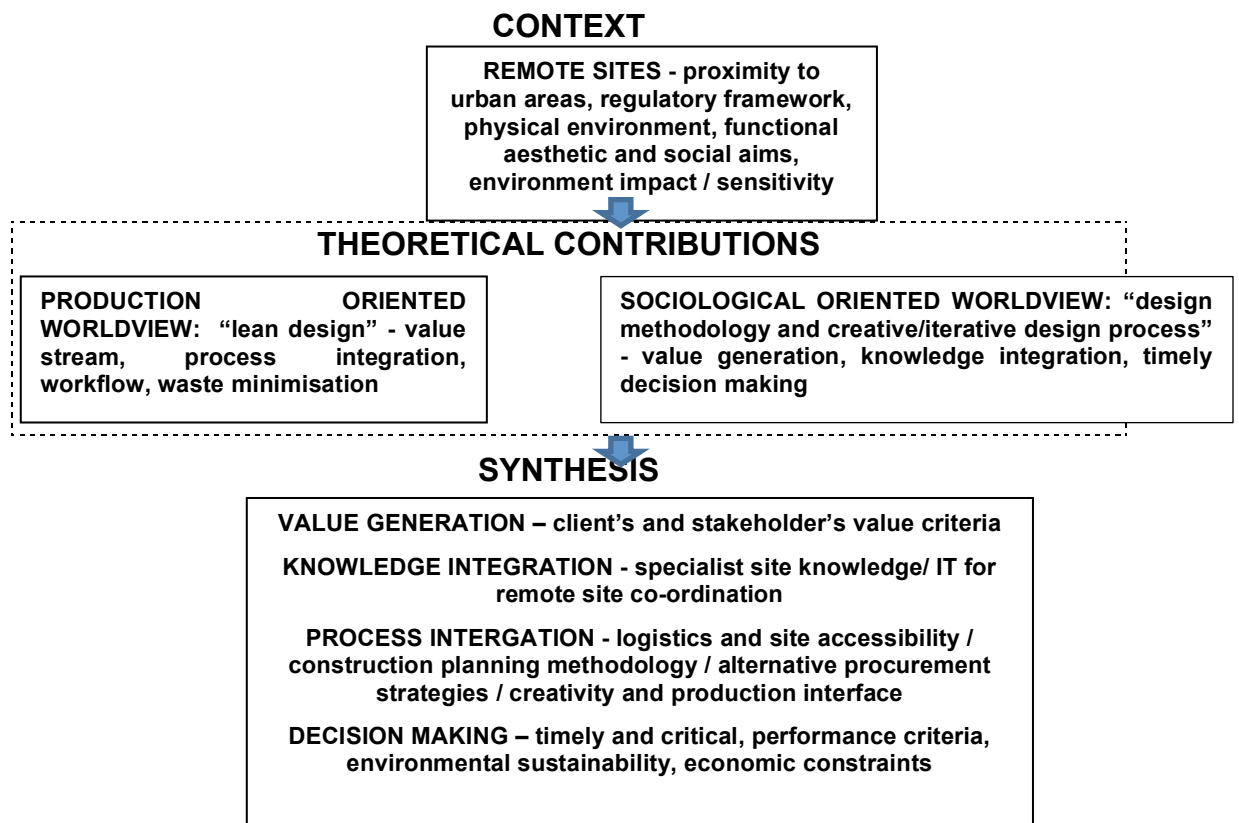
The development of theoretical models for the risk management of remote projects may be hampered by the absence of a coherent built environment axiomatic (as described by Chynoweth, 2009). This is further complicated by the fact that the effective management of the geological and environmental risks of remote projects, whether in academia or practice, requires contributions from the built environment *and* the natural sciences. It is clear, therefore that new models are required for both theory and practice-oriented solutions to this problem.

Using the risk management system proposed by Berkeley *et al* (1991), it should be possible to propose a framework for classifying and managing risk in remote construction projects similar to He's 1995 framework for the risk management of overseas construction projects (He, 1995), but this raises a further question – do remote projects differ from other projects simply in terms of their issues or are our existing protocols and systems less effective for this type of project?

In a series of papers Kestle (2002 to 2012) has posited the first published theoretical model for the design management of remote construction projects. The author contends that most construction companies take a logistical approach to the design management of such sites and that this is, at best, inappropriate for sites whose defining feature is often their environmental sensitivity (Kestle *et al*, 2002).

Kestle uses Kluge's definition of typology as a combination of attributes (Kluge, 2000) and the model identifies key factors for the design management of remote sites by "reviewing and synthesising theoretical contributions from various production and sociological approaches to design management and responding to a context of key characteristics of remote sites" (Kestle *et al*, 2002, p 308). Kestle's model is shown in Figure 2 below.

Figure 2 Conceptual Design Management Model for Remote Sites (Kestle and London, 2002)



The key factors of Kestle's model - value generation, knowledge integration, process integration and decision making – were tested in projects drawn from a most extreme category of remoteness and included tourism developments in New Zealand and Australia, a scientific drilling project in Antarctica and humanitarian relief projects in Sudan and Indonesia.

The aim of this work is to synthesise the values of sustainable design management with the more traditional process approaches generally taken to the management of remote construction projects. Although its focus is the *design management* (italics added) of remote construction projects, design management and construction management exist on the same continuum.

Kestle's inter-disciplinary model offers a potential risk management framework for remotely sited projects in the Highlands and Islands of Scotland and has much to offer clients and contractors. Construction research has been criticised for its adherence to quantitative, single disciplinary methods (Dainty, 2008) and the wider dissemination and use of a truly inter-disciplinary model for the effective management of remote construction projects, validated by qualitative research, is to be welcomed.

The model was initially developed for large-scale, scientific or “not for profit” projects and would clearly benefit from further testing in a more overtly commercial context. Additionally, the case study validation of the model was entirely retrospective. Since it is suggestive of early collaboration amongst stakeholders a possibility exists to test the validity of Kestle’s model in a fully-partnered live and commercial remote project in the Scottish Highlands and Islands

The Human Aspects of Remote Project Working

Whilst clients and contractors retain a logistical focus on the difficulties of remote projects (Kestle *et al*, 2002) there is increasing evidence of a human impact on the workers of these projects. The impact of FIFO (fly in fly out), long shift patterns and unsuitable accommodation mean that working in remote locations will tend to reduce productivity and increase fatigue (Sidawi, 2012; McAnulty and Baroudi, 2010; Haslam McKenzie, 2007), can have a negative effect on an employee’s family life (McAnulty and Baroudi, 2010; Haslam McKenzie, 2007) and increase problems with alcohol and drugs (McAnulty and Baroudi, 2010; Haslam McKenzie, 2007).

A key issue identified by several authors (McAnulty and Baroudi, 2010; Haslam McKenzie, 2007; Sidawi, 2012) is a severe skills shortage for remote projects at both managerial and trade level (perhaps not surprising when considered in the context of the potential effects for remote project workers outlined above); only towards the end of a cycle of growth or within a recession can skilled, experienced staff easily be persuaded to relocate to a remote project (Dainty *et al*, 2005).

Haslam McKenzie (2007) uses literature, policy, site visits, case studies, working papers, interviews and anecdotal evidence to produce a toolbox for companies and agencies seeking to attract and retain skilled and professional staff to remote locations of Australia. The report suggests that good practice can involve the use of promotional material highlighting the many positive features of remote localities, buddy systems which pair workers with significant remote experience and those without, rewards for remote service, targeting people at later stages in their career (once they are free of child-care issues), creating a workforce from local people who will already be adjusted to the climate, have local ties and a strong sense of place and improving equality practices and creating more opportunities for women. The author quotes Dunbabin and Levitt (2003) whose international review of recruitment policies for doctors to remote locations found that employing skilled and professional people who had either been brought up or trained in remote communities improved staff retention.

Sidawi (2012) uses a literature review and quantitative research to discuss the potential for the use of Communications and Project Management Systems (CPMS) in remote construction projects procured by the Saudi Electric Company (SEC) in the Kingdom of Saudi Arabia and to propose a technological solution to some of the human aspects of remote project working.

Building on the work of writers such as Deng *et al* (2001), Kestle and London (2002, 2003), McAnulty and Baroudi (2010) and Thorpe (2000), the author examines the problems encountered by the SEC in the management of its remote sites – issues such as skills shortages, logistical problems, long travel times for staff, the reluctance of contractors to undertake such projects, site ownership disputes, poor communication, the excessive workloads of supervisors and climatic problems

are discussed. Current project management practices used by the SEC in its procurement of remote construction projects are also examined.

Using both a literature review and analysis of the results of a survey of SEC supervisors, engineers and contractors Sidawi concludes that CPMS tools, when combined with partnering and improved information to tenderers, would help provide speedier feedback of queries to site, quicken decision-making, monitor the procurement and consumption of construction materials, as well as provide feedback on project progress, improve security and reduce stress and tiredness.

While these authors clearly frame the human issues redolent of both permanent and transitory remote community life, little evaluation of the best practice observed is offered and McAnulty and Baroudi's quantitative research (based on results of a questionnaire of middle and senior construction professionals with remote construction experience) does not distinguish for role which might be important; a construction manager and a quantity surveyor might conceivably rank issues such as staff recruitment / morale, productivity and procurement differently.

In addition, there are important contextual differences between Australia, Saudi Arabia and Scotland which need to be noted. For instance, against a contrasting background in the UK of a prolonged and deep recession, to what extent do comparable skills shortages exist in Scotland for remote projects? Anecdotal evidence suggests that, just as mining creates competition for workers with remote project experience in Australia, workers with such skills in Scotland are similarly lost to large urban projects such as the new Forth Road Bridge in Edinburgh or Crossrail in London; but further work is needed to explore this. Whilst, in terms of the human aspects of such issues as FIFO and alcohol and drug misuse in Australia, it is likely that similar results might be found in surveys of Scottish workers most remote construction projects in Scotland are "dry"; anecdotal evidence suggest that problems resulting from binge drinking when workers fly home are widespread. Other issues, problematic in Australia and Saudi Arabia will clearly be of less concern in a Scottish context – for example, extremely hot weather and the availability of potable water supplies. By contrast, and unlike Australia and Saudi Arabia, most remote communities in the Scottish Highlands and Islands are relatively well served in terms of telecommunications, banking and power supplies.

The adoption of virtual monitoring of construction activities as proposed by Sidawi (2012) in the UK could raise issues of educational culture and professional liability for consultants overseeing remote projects. Much current vocational training of consultants emphasises the primacy of site visits ("seeing it in person") over other forms of evidence for decision-making, particularly in respect of specification and scope of work changes. More work would be needed to understand consultants' reluctance to engage with the use of CPMS for remote decision-making in a UK context. The costs of establishing and maintaining an infrastructure for CPMS and the risks of implementing a "surveillance" culture of remote sites are also relevant here. However, with the increasing use of web-cam technology in all areas of public life, it may be that such fears are declining and there may be a generational aspect to this. Again, further work is clearly needed to explore this within a UK context.

Conclusion

This preliminary literature review has discussed definitions of remote, the rural built environment and landscape, the risk management and human aspects of remote projects and how an existing theoretical model and the use of CPMS might assist in the more effective management of remote projects in the Scottish Highlands and Islands.

The subject of the effective management of remote construction projects seems to be the focus of a small number of researchers based mainly in the southern hemisphere. Building on this research future work will establish a definition of remote for projects in the Scottish Highlands and Islands, further explore typologies of the landscape and rural built environment, identify and evaluate current risk management strategies in practice and validate the Kestle model within a live, commercial remote project.

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Differences Between Arab World Culture and British Culture Based on Hofstede Dimensions and Their Impact on Web Design

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Abstract

In the last decade, a series of studies have investigated the impact of culture on different societies, focusing mainly on the United States as a symbol of the West. However, little attention has been given to the Arab World in order to understand the influence of culture in the Arab society. Till now there are no reported studies that compare the Arab culture and British culture with the aim of identifying their practices and distinguishing the similarities and differences between them. There exist a number of qualifying reasons why this study has selected to compare and contrast the Arab culture and British culture. First there is a strong political relationship between Great Britain and Arab world, where the latter is one of the most imperative and influential areas in the Middle East. Moreover, the Arab world is an area of significant economic growth offering investors a myriad of opportunities across various business and societal sectors. Finally many UK small and medium enterprises have established links with the Arab world and it is important for these enterprises to recognise the practices and needs of the Arab culture to ensure successful interaction. Of great importance is also to study how cultural differences between these two selected societies influence and shape the design of websites, the centrepiece and virtual facet of many businesses. This paper recognises the need for websites to fit the profile and characteristics of target web users who typically construct their personality traits from the society and culture wherein they live. Cultural identities and differences will be identified using Hofstede dimensions and direct implications for web design will be drawn from these differences. The main purpose of this paper is to contribute to understanding the complexity of Arab and British societies and attempt to determine how the differentiation between Arabic and British culture impact web design.

Keywords

Culture, Hofstead, Web Design.

A comparison between Arab culture and British culture

In the last decade, a series of studies focused on investigating the impact of culture on different societies. Nevertheless, the majority of these studies have concentrated on the United States, which symbolises the West. The Arab world, however, has received little attention in regard to unravelling the link between culture and influences on the society.

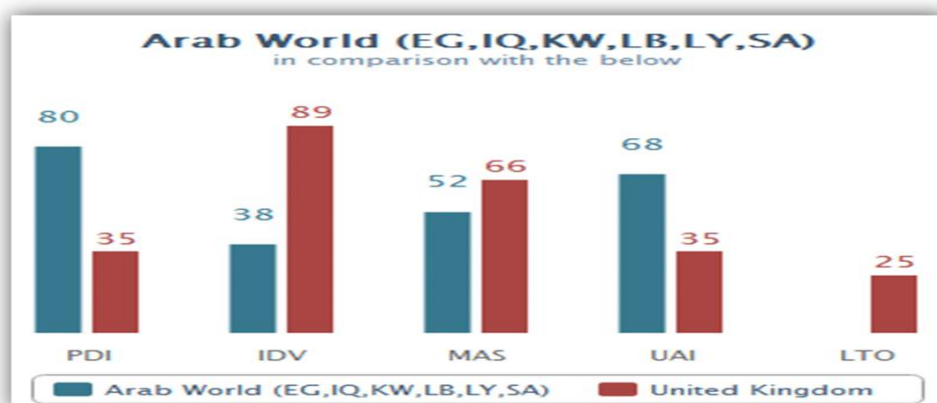
Comparison wise, there are no documented studies in the literature that systematically compared the Arab culture and the British culture with the aim of identifying the differences and similarities of the two cultures. In particular, we lack understanding of the factors, identities, and impacts that constitute the

two cultures.

The Arab World consists of 22 countries spread across North Africa and Middle East. These countries share one language, one religion (more than 90 % are Muslims), cultural value and traditions (Barakat, 1993). In addition, there are more than 380 million inhabitants today in the Arab World, and this number is anticipated to reach 435 million by 2030 (El Sherif, 2012). Whilst Arab countries do share commonalities, there are admittedly some variations between the Arab countries especially in regard to the degree of cultural acceptance of certain practices such as the dressing code. In general the societies in North Africa are more similar to western societies than Middle East societies are to western societies.

The big market in the Arab World provides a great opportunity for companies and organizations around the World to find a place for investment, especially in the current global economic crisis (Mahajan, 2012). It is therefore crucial for those companies and organisations, which consider to initiate links and establish business relationships with the Arab World, to understand the culture and dynamics of this region. Simply because misunderstanding a particular culture and its centerpieces can negatively impact the performance and success of businesses and projects. Comprehending the culture of others also explains and answers a wide range of questions like why many projects, companies and programs are successful in some areas and unsuccessful in others, and why people look at programs or software's from different angles, and why for example transfer technology meets much resistance from other societies and cultures. Studies have shown that the most important variable on the reaction of how people behave is the culture and the constructs that govern that particular culture (Harry. Et al, 2002; Leung et al, 2005)

It is safe to say that significant differences can be identified between the Arab and British cultures. For instance, in the UK a large proportion of the people are Christians, whereas in the Arab World the majority of the people are Muslims. This difference shows the background of two societies' which is dissimilar and the method of viewing things which is also different. In addition, it shapes their values and principles.



This factor when combined with the language factor shows the gaps and differences between the two cultures. The figure above shows Hofstede's study along with the results. Based on Hofstede (2001) dimensions, the Arab World society and British

society, and their characteristics vary significantly on the four dimensions. The results of Hofstede's (1984; 2001) shows that the power distance score (PDI in figure) for the Arab World is 80, which is considerably higher when projected against the PDI score of the UK, which is 35 (Mohammadi et al, 2010). In the Arab World, decisions and orders are made by chiefs and then delegated to subordinates to accomplish. Arab countries are authoritarians in nature, where chiefs are responsible for making decisions, and whatever they decide is right and should not be challenged by others. As such, the subordinates cannot function without prior knowledge and agreement of their chiefs, otherwise the consequences are often not favourable. The decision making process in the Arab World is very centralised and usually depends on one key figure. This decision making process reveals how people think and act, and how power is delegated within a chain of command in the Arab World. On the other hand, managers or supervisors in the UK can make a decision usually after negotiating with subordinates and taking into account various opinions and perspectives. This consequently makes the decision process less centralised, enabling the supervisor to receive the necessary support to achieve his duties. Engaging employees also provides new ideas to reach a well-rounded decision. In effect, responsibility is shared between the supervisor or first manager and employees. Moreover, in the west openness and fairness allows an employee to complain to the manager in case of disturbance or disagreement about a particular decision and this is usually taken into consideration and studied. This interaction and positive criticism are often two healthy elements in the decision making process.

In uncertainty avoidance (UA) element, the Arab World scores 68 in comparison to a UA score of 35 in the UK. High uncertainty avoidance refers to the act of taking a minimum risk and resorting to established methods rather than trying new approaches. Indeed closed cultures in the Arab World are usually bound to stick to existing and well-established approaches to performing tasks and solving challenges. They are usually reluctant to try and adopt new approaches as a result of fear of what could result. This obviously restricts creativity and demotes thinking outside the box. However, the British culture is more willing to embrace new ideas, methods and challenges to achieve better results and improve their traditional ways of performing tasks.

The Arab World's individualism score is 38 as a result of the collectivist society where the concept of togetherness is very important and strong. Notably this score is considerably lower than the UK's individualism score of 89 which is one of the highest score in the World. Individualism members are directed by personalised philosophies, and objectives instead of a collection. The focus is to consider the interests of oneself and make decisions without little consideration of how it may affect the group.

Furthermore, the Arabic society often puts the family in the central consideration rather than any other things. Relationship with the family, friends, neighbours, and general society is crucial in the lives of the Arab people.. An Arab person is typically concerned for the group and exchange for devotion.

In contrast British people are more self-interested and in a sense selfish. The member of the group considers solely his interests, and sometimes of his close family rather than the whole society. In fact, privacy and individualism are the centre of any action that can be done in the West (Buda, 1998).

Notions such as reputation, dignity, shame, and honour, is less considered and recognised in the British culture society than in the Arabic society. In the Arab society dignity is looked at as a very important and serious aspect of every family and member of the society. For example it is unacceptable for man and woman who are not related to have a relationship outside marriage such as being a friend.. In Saudi Arabia, for instance, it is forbidden for unrelated opposite gender to kiss, hug, or even shake hands when socialising. In contrast, these very examples are totally acceptable in the culture of the UK. Shame is a high-profile concept and thought to be brought to a family in the Arab culture if a member of the family do something that defies the accepted principles and values of the Arab Culture. The consequences are usually severe for someone who brings shame to the family, by both the family and society. In some cases the member maybe disowned by his family and rejected by the society. In addition Arabs give reputation a special treatment. A person is usually judged through his reputation in the society. Thus people would avoid things that can harm their reputation. Another factor that plays a big role in the Arab society is the family background and roots which can measure the position of a particular person and family in the society.

Arab World's masculine aspect obtained a score of 53, while the UK achieved a slightly higher score of 66. , Thus the British culture is more masculine, where competition and assertive receive a higher consideration inside the society. The Arab World slightly rates more equal and balanced in the relationship between male and female when compared to the UK society.

A summary of the main cultural differences between the Arab World and the UK

The following table lists the differences between Arab and British cultures:

Hofstede Dimensions	Arab Society	British Society
High/Low power distance	Power is unequal. Decisions follow a top-down approach, usually come from the chief to subordinates. Decisions are more centralised.	Responsibility is shared between the supervisor and respective subordinates. The decision making process is less centralised.
Masculinity / Femininity	Masculine society. More equality between male and female.	Masculine society. More assertiveness and aggressiveness.

Individualism and Collectivism	Collectivist and more oriented society. The person has a high concern for the group and exchange for devotion. Reputation, dignity, shame, honour, and pessimism occupy a higher consideration.	Among the highest Individualism scores in the world. Privacy and individualism are the centre of any action. The person focuses only to himself, and close family rather than the whole society.
High/Low Uncertainty Avoidance	Do not like to take a risk and prefer to use traditional and established methods.	Prefer to try a new way / approach instead of traditional ways.

The link between Arab culture and web design

In the last decade a number of studies explored the relationship between culture and web design. (Zhao et al 2003) have studied the Cultural Dimensions of Website Design and Content between American and Chinese societies, and stated a difference in the content characteristics and design. Singh and Baack (2004) investigated the American and Mexican websites.

This study showed important differences in the description of local cultural values on the Web. Differences, were not limited to cultural variations, but extended to the usage of language, color, icons, signs and symbols. Marcus & Gould (2000) conducted a study on cultural dimensions and global web user interface design by examining various global websites by applying Hofstede's cultural dimensions. Sun (2001) carried out an exploratory study on web pages and found a cultural impact on the design of any website, which is deemed as a crucial factor to increase the usability of multicultural websites.

Kim & Kuljis (2010) showed a study to compare UK and South Korea charity websites using Hofstede cultural dimensions. The authors concluded that there exist differences between these two cultures as reflected in the design of the websites and the differences can affect the user's assessment of a particular product.

Moreover, there are a few studies that investigated the relationship between culture and web design of Arabic websites. For example, Khushman (2009) argued that e-business websites developed for the western culture (i.e. for low power distance, low uncertainty avoidance, high individualism, and high masculinity cultures) are not compatible with the Arabic culture (i.e. high collectivism, high power distance, high uncertainty and low masculinity culture). These characteristics impede the use of new technologies. This study revealed that Hofstede dimensions do not reflect the design characteristics of Arabic user interfaces. However, this suggestion may need further studies to explore to what extent culture impacts the behaviour and judgment of Arab users on websites. Marcus (2009) has studied the influence of the culture on Arabic websites, and chose three countries as a sample from the Arab countries. This study was based on Hofstede cultural dimensions and provided important insights into the link between Arabic culture and web design. Mainly Arabic web users prefer more

representative pictures and links to external websites, and desire to see more multilingual content and interactive design features. However, this study lacked precision as it did not rely on a questionnaire and interviews with actual users to gather data. Instead it relied only on empirical observation.

These studies have proved mostly that, designing a site for a particular culture might not be appropriate to fit into different cultures. Every culture is controlled by its language, customs, traditions and meanings of symbols and words. Every culture has its own characteristics that are unique and distinct from other cultures. However, this does not mean that there are no relationships and commonalities among cultures. Indeed, cultural differences should be taken into account when designing any web site, whether educational or commercial or any other type, to ensure success and usability. Taking these factors into consideration will enhance the marketability of the websites and systems to make it more competitive than before in the market. This will also enhance the trust of users from differing cultures, such as the Arab World where concerns about privacy and security are high.

The empirical links between culture and design sites for the Arab users from the one side and Hofstede Dimensions from the other side emphasises the need for web designers to consider the pattern of thinking of Arab users, which differs to the English users. For instance, knowing the role of the family in Arab society may change the outlook of website design radically. Portraying a picture of a family on the web page instead of a single man, woman or child sitting alone is maybe more impactful. If the web designer values this factor, it may play a significant role in the success of the web site and provide a good opportunity for the designer to learn about the needs and desires of the target users.

Conclusion

To conclude, the Arab World culture is distinct from British culture and the differences are evident across all four Hofstede dimensions, namely High/Low power distance, Masculinity/Femininity Individualism and collectivism, High/Low Uncertainty Avoidance. These differences explain why it is crucial for companies and businesses in the Arab World to build different multilanguage systems and software applications that accommodate the Arabic culture dimensions. In future work, we endeavour to discover more differences that can confirm this theory and impact the design of websites. This is because different cultures reflect different views of the same thing, providing various explanations for what's happening around us. Different cultures also mean different ways of thinking, style of living and social lives. Such cultural differences must be taken into account when designing a website or producing a targeted program to a different culture, particularly when the differences are evident and at the opposite end, like our case. This comparison provides initial insights about how these dimensions can affect the usability of any system or software developed for an Arab audience.

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The impediments of contract culture to effective conflict management

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Abstract

Construction contracts have been criticised for being “adversarial” and not conducive to “constructing the team”. This paper forms part of an on-going doctoral research project that explores the extent to which standard form construction contracts, produced by each of the three main UK authoring bodies, address the possible cultural impediments to effective conflict management. The paper explores the practical application of what Guest et al (2012) describe as “Applied Thematic Analysis” to the study of construction contracts, within the context of contract based cultural impediments to effective conflict management. In so doing, the author presents an Applied Thematic Analysis methodology as a skeletal road-map to the doctoral research being undertaken, offering the potential for a contribution to the advancement of knowledge within the built environment.

Keywords

Construction Contract; Culture; Conflict; Applied Thematic Analysis

1. Research Purpose

The objective of the research, through the lenses of the data and the epistemological orientation of the researcher, from which this paper is drawn, is to evaluate a commonly used standard form of contract produced by each of the three main construction industry-authoring bodies to reach a conclusion to the thesis question:

'To what extent do construction industry, commonly used, standard form of contracts, published by the three main UK standard form construction contract authoring bodies, address the possible cultural impediments to effective conflict management?'

2. Research Methodology

In consideration of the background to the research methodology, the author, a researching practitioner, notwithstanding an extensive but continuing literature review, tentatively set forth to conduct the research using “Qualitative Document Analysis or Qualitative Data Analysis” (hereafter referred to as “QDA”).

This paper is a product of a continuing process of refinement of the methodology that was tentatively adopted in the early stages of a piece of research being undertaken by the author, procured through the continuing literature review. During the development, it became apparent that the research methodology may potentially offer a greater contribution to academic knowledge than the subject matter itself. This epiphany determined that a development in the degree of detail to be provided

within the research upon methodology is necessary, to reflect the emerging potential for contribution to knowledge within the research.

The following methodology, draws upon a development of QDA labelled by Guest et al (2012) as “Applied Thematic Analysis” or “ATA”. In the context of the overall research, the intent of the paper is to provide a systematic and transparent skeletal road-map of the process from which the researcher may draw and be guided so to achieve a persuasive and rigorous piece of QDA, that may both enlighten and assist others in the future.

The inductive nature of the analysis, orientates the research towards description and exploration, in which specific analytical categories or “codes” are not predetermined, but derived from the data. The process calls for the researcher to read and re-read the data, in this instance documents, looking for key words, trends and themes to inform the document analysis prior to analysis actually taking place. These are not discrete procedures, on the contrary, isolating relevant text segments necessitates at least some form of code, note and/ or query identification. Themes are not codes, and a theme can lead to many codes, but the systematic segmentation of text is a transparent approach. Accordingly, the product of this research may be used to generate hypotheses for further study.

3. Text Analysis

Bernard & Ryan (1998) identify that text can be analysed both in and of itself, i.e. with the structure, the meaning of the text and the words themselves, but also as a reflection of the author’s experience, perception, feelings, knowledge and behaviour. The latter form of analysis with which this research is focused, known as the sociological tradition (Tesch, 1990) is said to be utilised within the social and health sciences¹¹.

Since it is free text that contains the majority of the qualitative data available, certainly with regard to freely available standard form contracts published by the contract authoring bodies, i.e. document analysis, the researcher narrowed upon this branch identified by Bernard & Ryan (1998), in which the distinction between analysis either by words or by themes & codes is made, especially since the data pre-exists the study rather than having been gathered, it is therefore not the product of a systematic and structured process of elicitation direct from sources.

Guest et al (2012) explain that quantitatively focused word analysis methods, i.e. simple word counting or semantic network analysis, requires the assessment of how often a particular word or phrase is expressed within a body of text, thereby ideally revealing key words or phrases. Such methods can be efficient and provide reliable data, and computer software is available that assist. The use of computer software within the analysis limits the capacity for researcher interpretation of the data, but this is the basis for the reliability from a positivist perspective. The interpretivist school argues however, that such method is limited, since key concepts are simply brushed over, and it is with such concepts that this research is concerned.

4. Thematic Analysis

Thematic analysis in the development of cultural models is simply not word or phrase quantification, but rather demands identification and interpretation of

¹¹ Renata Tesch specifically refers to Sociology and Psychology qualitative research in the book.

implicit and explicit themes within text, drawing the researcher in. The codes are generated from themes identified with links to the raw data for subsequent analysis, but it's the researcher's involvement within the interpretation process, codifying, and code application that potentially may limit reliability. Multiple analysts exacerbate matters and in such instances further measures are necessary to ensure consistency, but in this instance the researcher is the sole analyst. Regardless of the potential limitation however, to reveal the complexities of meaning within text, thematic analysis remains (according to Guest et al, 2012), the form of analysis most frequently applied in qualitative research.

5. Applied Research

Whereas pure research is intended to advance existing knowledge or to satisfy a sense of, often professional, curiosity; applied research is used to denote research for identifying a practical solution. In this instance too, the researcher is seeking to understand and explain the extent to which standard form construction contracts, produced by each of the three main UK authoring bodies, address the possible cultural impediments to effective conflict management in a rigorous, reliable and valid fashion. Accordingly, the research should be supported by the data collected and analysed in a systematic and transparent manner.

6. Grounded Theory

Creswell (2007), Guest et al (2012) and Grix (2004) explain that ATA's reliance upon supporting claims with data, is characteristic of *grounded theory*, itself an inductive and iterative group of techniques intended to establish structures and themes within text that are drawn upon to establish distinct theoretical models (Punch, 2000; Corbin & Strauss, 2008; Glaser & Strauss, 1967); whilst Charmaz (2006) describes grounded theory as a set of methods that:

"...consist of systematic, yet flexible guidelines for collecting and analysing qualitative data to construct theories 'grounded' in the data themselves"

and Creswell (2007) notes that Clarke (2005), repositions the researcher from the "all knowing analyst" to the "acknowledged participant".

Bernard & Ryan (1998) describe a 4 step process to grounded theory:

1. Read the texts.
2. Identify themes.
3. Compare and contrast the themes, identifying structure amongst them.
4. Establish theoretical models whilst comparing the same with the data.

ATA follows the same steps save that with regard to the fourth, rather than grounding a theoretical model in the data, the product of ATA can be a theoretical model. Notwithstanding this distinction, in common with grounded theory, ATA adopts systematic data processing procedures by which themes and emerging theories are compared and contrasted in order to endeavour that thematic developments and interpretations are congruent with the data, this includes ongoing codebook development, code application, and data reduction. Further, just as discovering and exploring themes in grounded theory is an inductive process, codebook development is iterative since it cannot be finished until the last of the text is coded.

7. Phenomenology

ATA also bears similarities with phenomenology, which Creswell (2007) and Guest et al (2012) record is based upon Edmund Husserl and Maurice Merleau-Ponty's philosophical writing, the principle objective of which being the study of the subjective interpretations individuals attribute to their experiences and perception of reality (Creswell, 2007; Moustakas, 1994; and Schutz, 1962).

Interesting anecdotes however, do not persuade others of the relevance of a researcher's data; accordingly ATA uses a number of analytic processes to present the argument including quantification, data structure description and narrative. But ATA can be differentiated from both grounded theory and phenomenology given that quantification is used, and the former generally doesn't (Creswell, 2007; and Guest et al, 2012). Strauss & Corbin (1990) emphasise that grounded theory is a "*...nonmathematical analytic procedure that results in findings derived from data gathered by a variety of means*". Whereas ATA addresses research using a combination of the quantitative, interpretive and other techniques, that places ATA in an interesting position relative to the theoretical interpretative/ positivist debate upon qualitative research.

8. Interpretivism and Positivism

The debate between interpretivism and positivism is not new (Grix, 2004), with those within the interpretative tradition, which Grix (2004) and Guest et al (2012) note includes Geertz (1973), claiming the scientific method is reductionist and misses the objective of qualitative study. Creswell (2007) and Guest et al (2012) explain that whereas the positivist school views the interpretivist as too subjective, and argue that an objective image of reality should instead be sought within the confines of the study. But even with regard to this hotly contested area of academic debate, ATA draws from each tradition. Interpretivism traditionally stems from hermeneutics (originally biblical text interpretation), by which deeper meaning is explored within discourse and the understanding of multiple realities is sought; in contrast the positivists maintain a belief in a singular objective reality painstakingly following systematic analytic procedures to identify structure within the data and to create an environment conducive to quantification. Procedurally interpretative data analysis tends not to be so structured or focused upon quantification, but instead the meaning is interpreted within the discourse, i.e. the process is strictly qualitative. Whereas, positivism sits firmly within scientific method, upon fundamental notions that:

1. interpretation should be derived directly from data observed, and
2. data collection and analysis methods should be systematic, transparent, and repeatable.

ATA embraces elements of both positivism and interpretivism using various positivist biased data reduction techniques, whilst identifying themes interpretatively, although always against the original data.

9. ATA

Accordingly, Guest et al (2012) write that ATA uses grounded theory, positivism, interpretivism, and phenomenology within a methodological framework. It is rigorous whilst inductive. Just as a tradesman draws upon the tools from a tool

chest to undertake a task, the ATA researcher draws upon the most appropriate of techniques, systematically and transparently, from the available theoretical and methodological chests to complete the research task; but always with the overriding objective of achieving credibility through the accurate and comprehensive presentation of, in this instance, the textual data that is the subject of the research.

It is because the ATA researcher draws from the various theoretical and methodological perspectives, that the choices made from which to draw and to what extent have associated consequences that may need to be accounted for depending upon the researcher's epistemological persuasion, i.e. whereas an interpretivist may perceive a certain technique positively, a positivist may interpret otherwise, so consideration will be necessary.

It is the codebook however, that serves as the lens through which to view the data available, and the characteristics of the codebook lens is determined by the conceptual view sought by the researcher. QDA is a carefully thought-out exercise. Codebooks therefore vary depending upon the level of thematic identification sought, and need to be appropriate to the available data. Accordingly, the quantity of data, the degree of detail sought from the data, and the time available to the researcher will all have a bearing upon the degree of structure required from a scan of the data. This pragmatic approach of balancing a systematic process with the objective of the analysis, serves to distinguish ATA from grounded theory's painstaking word by word analysis. But ATA does not discard data if the resources are not available to cope with it, rather instead it is catalogued so as to provide others with the opportunity to analyse it in future.

Thereafter the analysis plan can be drawn, and in this instance the nature of it will be determined by the single report upon three contracts by a single researcher in the context of applied research. Having the specific analysis objective already identified it is necessary to identify the basic analytic approach to the objective, i.e. exploratory, explanatory or confirmatory, in this instance an exploratory basic analytic approach has been chosen, which, although commonly associated with grounded theory, given the intensity of the analytic approach and the difficulty that this creates with extensive textual data such as contracts, a modified approach can be successfully adopted using ATA, should the data collection be appropriately designed, providing breadth and depth in analysis.

The data to be used for the analysis is then chosen, in this instance three standard form construction contracts, a process which Guest et al (2012) describe as "*...bounding the view...*". Once completed Guest et al (2012) explain that it is necessary to decide how the text data is to be coded, which will depend upon the tools to be used (e.g. QDA computer software and if so, which?); initial codes are established and using an iterative codebook development process the coding will commence. Thereafter a summary will be prepared using numeric matrices to identify clusters where further analyse will be undertaken to answer the research question. Guest et al (2012) point out that there will be four key elements generated in the dynamic and iterative analysis process:

1. The characteristics of the sources – here the contract authoring bodies.
2. The primary information – in this instance the standard form contracts.
3. The secondary information generated to aid interpretation of the primary sources of information, such as codes, definitions and notes.

4. Information about the coder responsible for generating the secondary information, since it will be necessary to clearly account for the effect of such.

Another process used within ATA to achieve a systematic and transparent representation of the data is to identify themes and define boundaries, i.e. to segment, within the text. Guest et al (2012) write that whilst themes may be structural, i.e. applied to the research, content themes emerge from the data in the context of the research. Text segmentation is a powerful tool within ATA, enabling the researcher to evaluate and contrast data, but also to explore, compare and relate themes. Within larger studies it represents a distinct stage within the overall research design. In this instance given the structured nature of the subject text, the author intends to utilise a manual rather than computerised segmentation process, by which the researcher will segment the contractual text whilst reading during the coding process. This affords flexibility within the structure of contracts, and segments may possibly overlap where themes can be easily distinguished, particularly where a theme is spread across a number of contractual provisions.

10. Conclusion

The means by which the ATA researcher can collect and analyse qualitative data is as diverse as the available techniques and methodologies, the interpretation of which is then projected through the lens of the researcher's epistemological perspective. With characteristics common to grounded theory and phenomenology, ATA is demonstrably anything but new in its use of inductive thematic analysis, but significantly ATA's pragmatic use of the available techniques and methodologies in such a systematic and transparent manner within a positivist framework widens the options of analytic study, just as the painter draws colour from the artists palette together in different combinations to broaden the spectrum of colours available, ATA broadens the choices available to the researcher and the opportunity to present a more reflective image of the data through the lens of the researcher.

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Project Complexity: Open Questions, Conceptual Approaches, and Possible Analyses

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Abstract

Projects are an important part of most organizations, including of course, in the construction or aerospace industries. In the attempts to manage successful projects, complexity is one of the key challenges encountered. Higher the complexity, the higher is the challenge. But exactly what is complexity, and how to deal with its challenges? This article is dedicated to a better understanding of the challenge of project complexity and its impact on project success. In particular it deals with highly complex projects. This paper is prepared as the initial publication of a doctoral study aimed at developing a framework to cope with project complexity. It provides a brief review of the current understanding of complexity and how it is related to project management. Furthermore, it presents some open questions, conceptual frameworks, and possible ways to analyze projects. Such work may help better understand the aspects that either requires more clarity or successful approaches to manage complex projects.

Keywords

Adaptive, Complexity, Contingency, Management, Project

1. Introduction

First and foremost there is a need to clarify the difference between complicated and complex projects. The word “complicated” comes from the Latin *complicatus* (past participle of *complicare*) that means ‘to fold together’, and is related to projects that have a large amount of parts that are interconnected and interdependent. On the other hand, the word “complex” comes from the Latin *complexus* and *complecti* which means ‘to entwine’, and is related to projects where each individual part can change and that each change might or not affect the other parts (Cooke-Davies et al., 2011, Dictionary.comLLC, 2013). Another way to look into the difference between complicated and complex is on how much we know what needs to be done. In complicated projects, one knows what has to be done and, by following a specific process, one will probably reach the desired result, even though with some level of difficulty. In complex projects, one does not know what needs to be done (unknown unknowns) and there is a need to use appropriate tools and methods to overcome the existing uncertainties (Cavanagh, 2011).

There are many ways to characterize projects and their complexity. For example, one way to define project types could be by dimensions like size, risks, challenges, constraints, or uncertainties, or different forms of complexity levels. A complex system can be defined as “one made up of a large number of parts that interact in a non-simple way. In such systems, the whole is more than the sum of the parts, ...” (Simon, 1982). Project complexity can be associated with the project manager’s capability to manage that project (Baccarini, 1996).

According to Bar-Yam (2004), a complex project will only be successful if the complexity of the performing organization (the project team) is equal or greater than the complexity of the project itself. But what exactly is project complexity and what exactly is team complexity? How to characterize them, how to define them and more important how to assess them? Which key performance indicators should be used when dealing with such projects? (Cicmil et al., 2009).

The standard knowledge areas presented by the Project Management Institute (PMI, 2012) does not seem to be enough to deal with competing demands commonly present in complex projects. A new paradigm that goes beyond the Cartesian/Newtonian/Enlightenment should be developed since the standard Project Life Cycle (PLC) approach presents severe limitations as shown in recent research (Flyvbjerg et al., 2010, Klakegg et al., 2010, Baker and English, 2011, Rolstadås and al, 2011)

In this paper some questions are presented regarding project complexity. A better understanding of the concept will hopefully help to better assess the project upfront, and better manage it. Some suggested questions relate to the existing knowledge about the concept: what means project complexity – is it just one word, or it involves multiple variables and what are these variables; what is the best approach and methodology to a study of complexity research, and what needs to be done with the results, how useful and applicable they should and could be?

After this initial introduction, the next section is focused on some open questions about complexity.

2. Open Questions About Complexity

While complexity is a common word, there is not yet a full and commonly accepted answer to what it is. Different people think of different meanings when they use the word, as can be seen by the three references below:

- Kerzer and Belack (2010) define five elements of a complex projects: Size & cost, number and type of interactions, cultural implications, uncertainty, and stakeholders influence.
- Geraldi (2008) states that even though complexity can be present in projects, the lack of clear understanding of its meaning might lead project managers to miss the fact that some projects are actually complex systems.
- Complex projects have to deal with other variables like politics, size, technology, interaction with other organizations sectors, quantity of information to be managed, existing and new processes to be considered, and project management maturity level (Levin and Ward, 2011).

With that said, it would be appropriate to focus now on asking some additional questions:

People live in a complex world, but what does it mean? There is complexity of products, organizations, relationships, communication, societies, governments, politics, geographies, nature, environment, etc., etc. Should all these be part of a project's complexity?

Is complexity the same as complicated? What is complicated? How complex is complicated or vice-versa?

There are many frameworks in the literature defining complexity, starting with General Systems Theory (Hofkirchner and Schafranek, 2011), Boulding's nine levels of complexity in nature (Boulding, 1956), and up to today's levels of system complexity. Which ones are relevant?

Should complexity be seen in its narrow or wide sense? Is it just complexity, or does it include uncertainty, risk, constraints, etc., as well? Or are these aspects actually part of the definition of complexity? If the focus is on the word, it would be limited; if a wider approach is selected, maybe this word is insufficient, and there is a need to look for another term. A clarification of these questions must be done before starting; otherwise it will be impossible to integrate the results.

Do organizations deal with specific complexities or different variables of complexity? For example, complexity of requirements, markets, product and system, technology, organization, process, etc. Is there a distinction between complexity of independent variables, such as needs, and requirements, mediating variables, such as managerial, organizational, processes, and dependent variables, such as outcomes, products, performance, uses and users?

One critical question is, would it be the best approach to classify complexity on a scale of various levels? Should a classification framework be used? How many levels should it have? Should a continuous measure be applied? And if various dimensions are used, should each dimension have the same number of levels? Not using too few nor too many seems best.

How to measure complexity? Is a quantitative measure to be used? If it is on various dimensions, the measure should be in vector form. What is the best way to aggregate all measures into one number? What does that number mean for complex program management?

The following section presents a discussion about the need for more research with further questions to be asked.

3. Why is This Research Needed? Background Questions

In any literature review related to this subject, it is common to find statements proposing to address the negative effects of complexity in projects. A few of these issues are listed below (Hass, 2009, Flyvbjerg et al., 2010, Cooke-Davies et al., 2011):

- Over-estimation of benefits;

- Under-estimation of costs and time with consequently budget and schedule overruns;
- Fail to meet client requirements;
- Un-alignment between stakeholders with different and competing views of what is considered project and product success;
- Existence of internal and external factors acting against the right approach to manage projects;
- The organization does not assure to have the right people managing the right project.
- Lack of proper tools to manage complex projects, leading to overwork and low performance.

Other studies are suggesting models that are often not dealing with the difference among projects or their levels of complexity (PMI, 2012, Thomas and Mengel, 2008); and still others recommending approaches that deal with some aspects of project complexity but missing others (Flyvbjerg et al., 2010, Curlee and Gordon, 2011, Levin and Ward, 2011). Let's start with a few background questions:

- What about the positive effects of complexity? Perhaps a better understanding of complexity will allow to better exploiting a systems' potential? Why see only the negative aspect of complexity in organizational life?
- The majority of products today are more complex than before (think of today's cell phones). What does that mean? How does this trend affect program management? Do programs today have to be more complex than before? Do they require new managerial and leadership skills, which organizations currently don't have or don't build? Maybe there is a need to limit the level of complexity in some cases? Does everything need to be so complex?
- Many of today's complex programs fail to deliver their expected results, either meeting schedule and cost goals, or failing to meet their operational, customer, or business objectives, or all of the above. Some programs are cancelled before completion. As a result, excessive resources are wasted, and promising programs fall victims to customer or investor impatience.
- How well do companies today cope with complexity? What are the symptoms of the problems? And what are the causes? Do they know how to organize, plan and run complex projects? Do companies have the right organizational structure to deal with complex projects? Do they really know how to distinguish among complex programs? Are all complex programs the same? Is there a proper best organizational structure for each project?
- Is there a need for a complexity assessment tool? What would be its components? Is it going to consider one or several dimensions? Which are these dimensions? Should it provide an objective scaled result or subjective and project specific?
- Would a better estimation model be useful to help organizations make the right decision when estimating costs, time, risks, benefits, and other important aspects of a complex project implementation?

There is a need for a debate about these questions that will produce many additional insights that should be answered first, and later guide the focus of this research. Perhaps industry players can provide better insights to these background and other objective questions, before they provide answers about how they deal with complexity. More can be found within the extensive literature on mega-projects related to engineering and construction (Morrow, 2011, Altshuler and Luberoff, 2003, Flyvbjerg et al., 2010), both in the public and private sectors, that present similar challenges related to complexity.

After the presentation of background and open questions, it is appropriate to look into some additional concepts related to complexity.

4. Concepts Related to Complexity

According to Bar-Yam (2004), one may realize that complexity is not just a matter of the size, duration or the number of parts that a specific system has. Complex problems are the ones that do not have an immediate resolution and would persist on appearing. In other words, the resolution of complex problems is not easily done.

The more the human knowledge and especially technology advances, the more the existing systems become complex. Organizations are becoming more complex to deal with increasingly complex environments. One decision by an individual could impact an entire organization, or a decision of one region may impact the entire world. Today's interdependence of financial markets is just one example.

Uncertainty should be considered as a characteristic not only for complex projects but actually for any project. PMI's concept of project is "an endeavor undertaken to create a unique product, service, or result" (PMI, 2012). This uniqueness in what created the uncertainty, since projects will produce something that was never done before with the same resources, constraints, environmental factors, stakeholders, risks, time, etc.

Complex problems do not have one single approach that can be used to resolve them all. Each situation might need a different way of resolution, and different complex systems perspectives might be needed. One example of looking at complexity suggests that there are different possible approaches that would result in failure, but a very limited number, (if not only one), that will result in success. The more complex a situation is, the harder it is to find the few options that may lead to success.

Perhaps a possible way to deal with complex problems would be to understand the whole by figuring out what each part does. However, this approach rarely works because an important aspect will be missing – understanding how each part interacts with each other (Bar-Yam, 2004).

That also means that to manage complex projects, there might be a need to use a different skillset, more focused on the "soft skills" than the use of tools and techniques. According to Cicmil et al (2009), these skills also include intuition, holistic thinking, how to handle competing and sometimes conflicting values or requirements, how to deal with internal and external politics, stakeholders management, just to name a few.

Thus, to better understand complex systems, the concepts of interdependence and emergence must be considered. It is not just about 'breaking' the whole into its parts, but how they interact with each other. Clearly addressing interdependence (or

independence) of the parts, and how each part can affect the others is also necessary. What would happen if one applies change to one or a few parts? Would the entire system be affected? On one hand, there may be changes in some parts that have no or minimal impact on the whole. On the other hand, the opposite is also true – one change could have a great impact on the entire system (Bar-Yam, 2004).

Other concept to consider is Emergence, which is the relationship between the large scale (i.e. forest) and the small scale (i.e. an individual tree). Focusing on the large scale might allow one to see how the entire system works but will be missing specific details of each component of that system. The opposite is also true, so focusing on both aspects allows a better understanding of a complex system. Furthermore, it is also necessary to understand the existence of patterns – created or self-organized. For example if one observes an ant colony – the interaction between each ant creates a pattern that could be observed from a large scale (Cicmil et al., 2009).

Still another important way to define complexity is how hard (or easy) it is to describe the system. For instance, the amount of effort for describing a book would be much less than describing an animal. One can describe something by using words (written or verbal), graphical representations, comparisons, etc. If the understanding of a system is proportional to the understanding of its description, one also concludes that it should be directly related to how well the presenter describes the whole, the parts, and their relationship, but it also depends on the recipient's level of knowledge. For example, how would someone describe a chair to a 2-year old kid or to an adult? A poor description will create incomplete or faulty understanding, which will directly affect the success to deal with that system.

Scales are also important for a better understanding of complexity. The level of information available will guide the description, so the description of a forest would be a large scale one and the detailed description on a specific tree with all its leaves, root, trunk, etc, would be on a small scale. According to Bar-Yam (2004), complexity can be described as a function of scale and could be represented by the figure 1 below. Complexity would reside between fine scale (random/independent) and coarse scale (coherent). In other words, the way a system is organized (or self-organize) has impact on how it is perceived on different scale levels. What seems to be highly complex on a fine scale will look more coherent as scale become coarser.

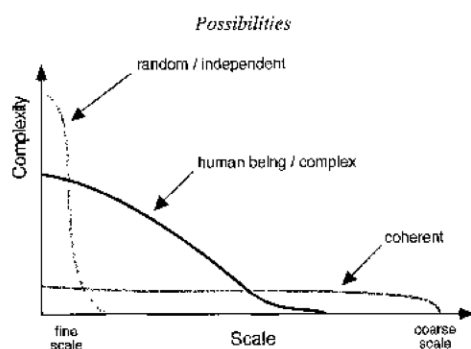


Figure 1 - page 55 (Bar-Yam, 2004)

The author suggests that there is a “...trade-off between large scale behavior and fine scale complexity. When parts are acting independently, the fine scale behavior is more complex. When they are working together, the fine scale complexity is

much smaller, but the behavior is on a larger scale. This means that complexity is always a trade-off - more complex at a large scale means simpler at a fine scale.”

Sharing a personal experience as a competitive rowing athlete comes the notion of cooperation and competition. The cooperation between four rowers representing the State on a four-skiff boat race was crucial for the success when competing with boats from other States. And there was also some competition between the entire group (around 10 rowers) to be selected as the top 4 athletes to compete and represent the State. The same happens in complex systems where you might have parts that compete with each other in order to have only the best ones to perform each task. However, more important than competition is the cooperation between the parts for the success of a project – high performance teams are the ones that work well together.

A conclusion is that people and their relationship within the project environment matters and could be one of the most important factors defining success or failure on a complex project.

Even though the above is not an extensive list of concepts linked to complexity, it might give the reader a reasonable idea, which will open now to the discussion on approaches to deal with project complexity.

5 - Supporting Concepts: How Could We Deal with Complexity

There are several approaches actually used to deal with the challenge of managing complex projects. An initial investigation reveals a few of them as below:

5.1 - Complexity Theory

Complexity Theory was originated from chaos theory (not covered on this paper). Even though Complexity Theory is more common in mathematics and exact sciences, it has been developed more and more in the social sciences, management and business as well (Curlee and Gordon, 2011).

According to Lucas (2009), “Complexity Theory states that critically interacting components self-organize to form potentially evolving structures exhibiting a hierarchy of emergent system properties”.

The main concepts defining the Complexity Theory are Complex Adaptive Systems, Nonlinearity, and Self-Organization and Emergence (Baccarini, 1996, Remington and Polack, 2007, Remington and Polack, 2008, Williams, 1999).

- The Santa Fe Institute based in New Mexico, USA, started to study in 1984 the behavior of the Complex Adaptive Systems (CAS). CAS can be better understood as a framework representing the complexity in natural systems, which would emerge from the interaction of multiple, simple, but adaptive, factors.
- Nonlinearity takes into account that even small changes on a system might have unpredictable impact in nonlinear systems.
- Self-Organization is the property that a system has to self-organize itself in an unpredictable way, considering that no external forces act upon that system. Emergence takes into account how diversity and variety arise in order to allow evolution to happen (Cicmil et al., 2007).

According to Remington & Pollack (2007), a complex project is a complex adaptive system (CAS), so this will be one of the aspects of a future research with the purpose to create a model that can be applied to most projects. The model should suggest how to adapt the project, in the same way that a system (biological, physical or social) adapts to its environment. Furthermore, projects can be considered as nonlinear systems, since they are by definition unique and uncertain. On the other hand, Self-Organization does not need to be considered since all projects, especially complex projects, will have external acting forces.

5.2 - Multi-Criteria Analysis – MCA

In another text titled *Capital Budget Valuation: Financial Analysis for Today's Investment Projects* (Baker and English, 2011), Chapter 24, the co-author Fernando Fernholz confirms the need for a multi-criteria analysis to support the decision making process in complex systems.

The concept and usage of Multi-Criteria Analysis is quite common. According to the authors, MCA is used in people's daily lives when making decisions not based on a single criterion, like buying a new car. Several criteria might be used during this process – safety, performance, and price, for instance. The same applies to projects where the traditional constraint – scope, quality, time, and cost – are actually criteria for decision-making and estimates. Recent developments called for additional criteria such as profitability and customer satisfaction.

Based on the goal of our proposed research, there is probably a need to use a comprehensive set of criteria to better estimate the costs and benefits of a complex project, leading by nature to a multi-criteria analysis. On the other hand, natural limitation of individuals making the decision or assessment related to the level of complexity and uncertainty involved should be considered.

Less knowledge or experience of these individuals might impact the results of each criterion used. For that matter, the focus would be on criteria that will take into consideration the level of competency that the “evaluator” would have during the assessment. The aspect that can hinder the efficiency of a MCA is the amount of information available. This aspect should also be weighted as a risk factor during the decision making process.

5.3 - Contingency Theory.

In *One Size Does Not Fit All Projects: Exploring Classical Contingency Domains* (Shenhar, 2001), the author explores ways to help managing projects by applying structural contingency theory to today's project environment.

The traditional contingency theory states that “different external conditions might require different organizational characteristics, and that the effectiveness of the organization is contingent upon the amount of congruence or goodness of fit between structural and environmental variables” (Lawrence & Lorch 1967, Drazin & van de Ven 1985, Pennings 1992). So, considering that each project has several external conditions that can influence the process of estimating costs and benefits, and its outcome, it seems fair to assume that a more accurate distinction would need to take into consideration as many conditions as possible.

According to Shenhar, the existing project management body of knowledge does not often consider the contingency theory since they propose a set of standard characteristics and approaches for any project at any level of complexity or uncertainty. That's why the "one size does not fit all" is quite applicable for projects, and especially for complex (and capital) projects. A more updated contingency theory would be required to deal with projects complexity and uncertainty.

5.4 - Adaptive Approach for Project Management

In their book, *Reinventing Project Management: The Diamond Approach to Successful Growth and Innovation* (Shenhar and Dvir, 2007) the authors introduce the adaptive approach to project management suggesting a multi-dimensional model for the analysis of a project.

The adaptive model ("The Diamond Approach") is more aligned with the model that shall be created as part of this research, supporting better costs and benefits estimates for complex projects. Even though the four dimensions proposed – novelty, technology, complexity, and pace – are shown to be useful to better analyze the project's benefits and risks, a more developed multi-dimensional model can be proposed, one that will include other aspects that may have a strong impact on a project's estimated resources. Such dimensions may include, levels of politics, type of stakeholders involved, and environmental aspects, just to name a few. It is the objective of this research to consider as many factors as possible but propose the few ones that will effectively help the estimation process.

6 - Conclusion and Way Forward

With the objective of sharing some open questions, conceptual approaches, and possible analysis on complexity and its association to project management, based on the initial literature review for a doctoral study on project complexity, the conclusion is that this field has advanced significantly in the last two decades and provided a better understanding of the subject.

Some of the key findings were:

- The understanding of complexity and how it is related to project management increased;
- There are still several unanswered questions, which is an open field for researches and organizations (i.e. International Centre for Complex Project Management) to find the answers;
- Once the questions are answered, there is an increasing chance to implement an effective assessment model to deal with the intricacies of project complexity.

The authors of this paper hope that this brief conceptual review and the posting of some open questions will help guiding not just their own research but also many other to come.

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Sustainability and Environmental Systems

Impacts of Highly-Glazed Tall Buildings on the Microclimate of West Bay of Doha: Urban Heat Island Effect Causes and Mitigation policies

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Abstract

Highly glazed tall buildings have a significant effect on the surrounding pedestrian level environment and microclimate. Roof materials, building heights, distances between buildings, and streets cover contributes to the formulation of the Urban Heat Island phenomenon. Recently, awareness has increased about this problem of Urban Heat Island creation around tall buildings and how it can affect the public health and the environment. The arrangement of buildings and complex plan forms has a significant effect on the microclimate. This paper studies the impact of highly-glazed tall buildings on the microclimate of the West Bay of Doha city. The methodology of the research is based on the analysis of an area in West Bay that addresses the problem. The analysis is in term of building height, building material, adjacent land cover, and spaces between buildings. The paper identifies the reasons behind the formulation of Urban Heat Island, and its environmental, economical, and social impact. Also, it proposes solutions to mitigate its impact on energy consumption and human health and comfort.

Keywords

Cool pavement- Green Roof- Highly glazed tall buildings- Sky View Factor (SVF)- Urban Heat Island (UHI).

Introduction

Historical background

Doha can be classified as a traditional Gulf city that grew earlier through sea related activities and recently out of the direct influence of oil. Stretching along the western coast of the Gulf that underwent similar growth experiences during their evolution. Doha's deep water has been a significant factor in its early development as a major port settlement signified by thriving fishing and pearl diving activities, where pearling was the most significant commodity of trade. (Al-Buainain, 1999)

Phases of development

First stage, early traditional stage: Between Doha's foundation and until the mid-20th century Doha continued to grow as a small port settlement. It remained as a fishing and pearling center even after the arrival of oil until the 1950's. A cluster of nine compact residential neighborhoods (locally known as Fareejs) made up the town with an estimated total built-up area of no more than 1.5 square kilometers.

These stretched nearly three kilometers along the coast taking an L shape. (Al-Buainain, 1999)

Second stage, the 1960's transitional stage: It went systematically without challenge for the three decades that followed the 1950s. Indeed, there were a few factors that contributed to the expansion of the city in the 1960s amongst these were the launching of the public housing law in 1964, purchase of substantial parts of the core areas by the government for re-planning and land reclamation of the coastline overlooking Doha Bay. Although these factors had a modest impact on the way the city was growing during this stage, there influences appeared to be far reaching in the subsequent stage. (Al-Buainain, 1999)

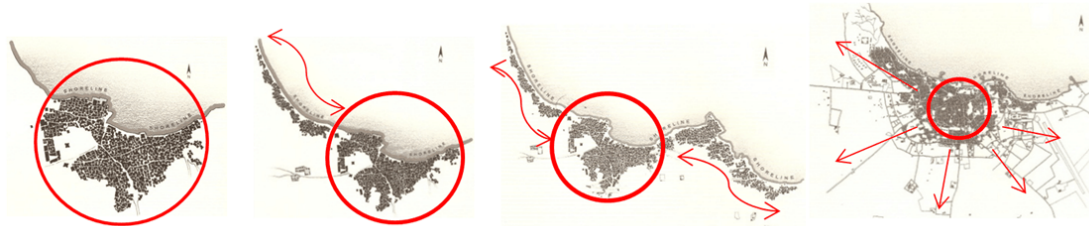


Figure1. Chronological evolution of Doha city from 1937 to 1959. (Lockerbie, 2013)

Third Stage, the rapid stage: The new economic growth in the 1970s particularly in the wake of the oil price rise caused the population of Doha to increase sharply as the tendency towards urbanization accelerated. Indeed, the redistribution trend of population, particularly during the 1970s through migration (both internal and external) towards the Doha area and intra-urban mobility created a massive demand for housing and other related infrastructure. To respond to the rapid pace of urban growth in the capital, the government intensified its public housing programs and land allocation policies. (Al-Buainain, 1999)

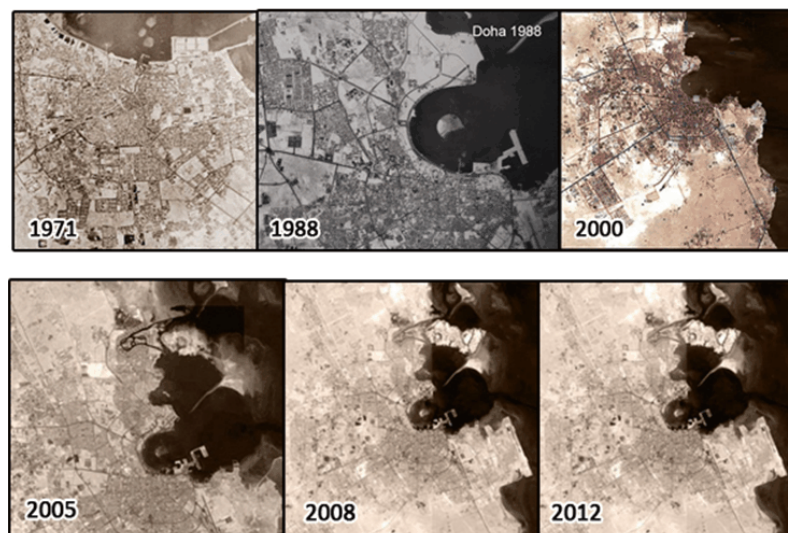


Figure2. Doha 1970s onwards (The Rapid Stage). (Mahgoub, 2011)

Characteristics of Hot-Arid Climate

Knowing that Doha has a hot-arid climate characterized with; being hot dry in summer, cold dry in winter, little rain fall, low vegetation cover, high temperature

difference between day and night, and the combination of wind and dust specially in deserted areas. These weather conditions implies certain urban and architectural features in order to defy these harsh conditions as they should have dense urban fabric, narrow irregular alleys sometimes vaulted, joined closed buildings, and suitable orientation according to the sun and wind. As for the architectural features to have a cooler microclimate they used to build homes with courtyard, solid walls with a small opening, and building materials as clay and masonry.

Main climates, example (1)	Basic Profiles (2)	Major problems (Issues) (3)	Basic urban design response (4)	Preferred urban form (5)
Hot-dry (middle east and north Africa)	Intense solar radiation Large temperature amplitude between day and night Dusty storms Torrential rain Low cloudy days Intense dehydration High salinization Evaporation exceeding precipitation	Excessive dryness combined with high day temperature Dusty and stormy	Compact forms Shadowing Evaporative cooling Protected urban edges from hot winds Windward location near a body of water Narrow winding neighborhood roads and alleys Mix of building height to shadow the city Small, dispersed, and protected public open spaces Circumferential and intersecting tree zones Use of Geo-space city concept	Compact form

Figure 3. Hot-dry climatic zone profile (Middle East and North Africa), major problems, basic urban responses, and urban form. (Golany, 1996)

Urban morphology of the old city of Doha (The heart of Doha):

The old town of Doha (Wadi Msheireb) has its own authentic character and street patterns. Streets are in the form of gridded organic lattice of traditional Islamic urban form, also, a lattice of shaded pedestrian lanes and walkways which creates intimate alleys for people and allows the creation of independent microclimate in the area that can defeat the extreme weather conditions. The state started a regeneration project for the old downtown of Doha city called “Msheireb HOD - Heart Of Doha-“, is an ongoing project for the revival of the old city that saves it from the deterioration it has undergone.

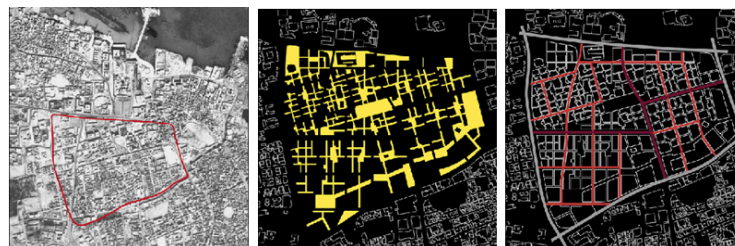


Figure 4. Urban fabric of the old city of Doha. (Musheireb Properties, 2009)

Architectural typology of the old city of Doha (The heart of Doha):

Respecting the Islamic culture, the buildings in the old city of Doha reflected the traditional Islamic urbanism with its organic courtyard patterns that reflected the deep-rooted family traditions of privacy and security, houses are arranged as neighborhoods “freej” clusters, each cluster shares a communal majlis and courtyard.



Figure5. Architectural typology of the old city of Doha. (Al-Buainain, 1999)

Obviously, Doha's downtown urban morphology and architectural typology had followed old Islamic city style. This city style is perfect for such climate as the hot-arid climate. During the regeneration project of the downtown, measures were considered to provide a better microclimate than the existing one.

Urban morphology of West Bay (case study):

By the mid-seventies, the State was developing its infrastructure, but a number of problems, were becoming increasingly apparent. The central area had been demolished in such a way as to make contiguous development difficult. At that time, the West Bay of Doha was shallow and was not cleansed by the water currents running down from the north. The government took the decision to dredge the bay and, due to a number of reasons and reclaim a new area from the sea upon which the government might develop. The Ministry of Public Works awarded the specialist dredging company (Bos Kalis Westminster) the contract to carry out the reclamation of a part of the West Bay. The American architectural and planning consultancy of William L. Pereira Associates was introduced to assist in this process. By the end of that year, they had produced the first in a series of planning studies known as the Concept Plan, and which would provide the outline for development of this area. The elements that were to be located in this area, now known as the New District of Doha which are (Qatar University- a regional park- Senior staff housing- Intermediate staff housing- a 500 bed hotel and conference center- a diplomatic area- a ministries area- a district center- and central business district). (Lockerbie, 2013)



Figure 6. West Bay area urban fabric. (Lockerbie, 2013)

Architectural Typology of West Bay (case study):

The New District of Doha was an opportunity to establish high standards of design and construction within the State. It was not anticipated that buildings would be of the significant height they now reach. Ten to twelve stories was sufficient to cater for the needs of the business and State requirements at that time. One of the key initiatives intended to encourage the development within the new plan for Doha was a competition for the design of ministries complex for Doha. Firstly, the project was intended to fulfill, or at least seed, the growing need for government offices that were not required to be either security discrete or location-specific. Secondly, it would be one of the projects intended to establish high standards of design and

construction, it would create an organized facade to the Corniche which was conceived as having a recreational and ceremonial status in the road hierarchy, thus creating a recognizable face for the emerging capital of the peninsula. (Lockerbie, 2013)



Figure 7. West Bay area architectural typology. (Thompson, 2012)

Problem statement

If the main goal of urban design is to provide a pleasing and protective environment, then climatic consideration becomes the central part of environmental urban design. Taking climate into consideration is not an issue of perception and comfort only. Climate affects the health, the social life, and the productivity of the inhabitants. First, the research aims to identify the reasons behind the formulation of UHI in West Bay. Second, to investigate its impact on environment, economics, and social life. Finally, provide mitigation strategies to reduce the formulation of the UHI.

Doha is characterized with hot-arid climate that implies certain architectural and urban features to defy the harsh weather. Construction of highly-glazed tall buildings in West Bay did not follow this pattern at all in terms of building materials, urban fabric, and land cover. This architectural typology and urban morphology harms the microclimate of the West bay area, creating Urban Heat Islands. Urban heat island phenomenon can affect the human health, comfort, and sustainability in terms of energy consumption.

Research design

The research starts with comparing the old city of Doha to the modern one through studying the urban fabric and architectural features of the old city and the modern city. This analysis proves that the urban fabric and architectural style of the old city of Doha is more compatible with the local weather conditions. Also, it highlights the main issues that West bay suffers from. Urban heat island is one of the main concerns that affects the micro-climate of the area. The research finally suggests some mitigation strategies to minimize the impact on the microclimate of West bay.

What is Urban heat island (UHI)

The unique microclimate of cities is the result of their complex built environment. Their lack of cooling vegetative surfaces, and their increased anthropogenic activity blend together to create a thermal contrast between urban and rural areas. This distinctive temperature pattern is at its most pronounced during the night, when the release of stored heat and the containment of outgoing long-wave radiation in urban areas combine to make them systematically warmer than the countryside. This 'urban heat island' (UHI) can lead to temperature differences of up to 7°C between

the centers of large conurbations and their surrounding rural areas. (Smith & Levermore, 2008)

In the dry-climate city, solar radiation, absorbed throughout the day by the buildings, is quickly diffused back into the air during the evening. The temperature drops significantly due to the lack of clouds and the low relative humidity. A dense built-up area will release this temperature slowly. The cooling process within the city center is slower than at its peripheral part due to the heat absorbed throughout the day. City configuration, street patterns, and structure of the houses influence the velocity of wind penetration within the city. The city center is supplying an increase of temperature throughout most of the day by the intensity of its human activities and car traffic. Air movement or air turbulence also may be caused by heated air rising in the city center and drawing cooler air from the periphery to replace it, through straight and open streets. (Golany, 1996)

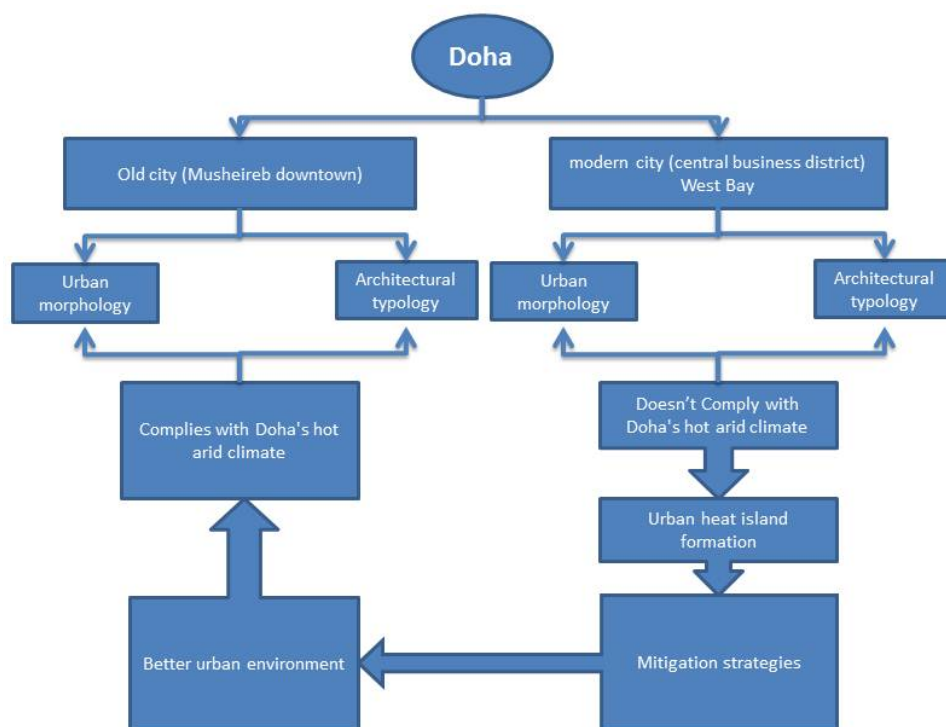


Figure 8. The research Design.

Major causes of Urban Heat Island (UHI)

- 1- Distance between towers can be measured by the sky view factor (SVF) which quantifies the openness of a site within an urban setting that has significant implications for incoming and outgoing radiation and thus heating and cooling pattern. Reduced SVF increases solar radiation decreases radiation loss and reduces wind speed. (Grimmond, 2007)
- 2- Reduced vegetation in urban areas. (Climate Protection Partnership, 2010)
- 3- Properties of urban materials, in particular solar reflectance, thermal emissivity, and heat capacity, also influence urban heat island development, as they determine how the sun reflects its energy, emitted, and absorbed.
 - **Darker surfaces** tend to have lower solar reflectance values than lighter surfaces. Researchers are studying and developing cool-colored materials. These materials use specially engineered pigments that reflect

well in the infrared wavelengths. These products can be dark in color but have a solar reflectance close to that of a white or light-colored material.

- **Surface materials** in urban areas, such as roofing and paving, which have a lower albedo than those in rural settings. As a result, built up communities reflect less and absorb more of the sun's energy. This absorbed heat increases surface temperatures and contributes to the formation of surface and atmospheric urban heat islands.
 - **Material's heat capacity**, which refers to its ability to store heat. Many building materials, such as steel and stone, have higher heat capacities than rural materials, such as dry soil and sand. (Climate Protection Partnership, 2010)
- 4- Two primary weather characteristics affect urban heat island development: wind and cloud cover. In general, urban heat island is formed during periods of calm winds and clear skies because these conditions maximize the amount of solar energy that reach the urban surfaces and minimize the amount of heat that can be released. Conversely, strong winds and cloud cover suppress urban heat islands. (Climate Protection Partnership, 2010)

Major causes of Urban Heat Island (UHI) in the case study- Data analysis.

The case study is located in the West Bay area business district. The chosen area has a high concentration of towers with a less density area surrounding it. Most of the towers located in this area have an average height of 150 m, and average width of 30 m. Distance between towers ranges from 15 to 58 m maximum.



Figure 9. Urban heat island formulation in the case study.

1- Distances between towers

In the case study distances between towers is narrow which reduces the SVF, this accordingly creates UHI between the towers. UHI formulation leads to increase in temperature, slowing the loss of heat gain at night, and reduction of wind speed. Eventually, this affects the pedestrian thermal comfort and slow the rate at which cities cool off at night.

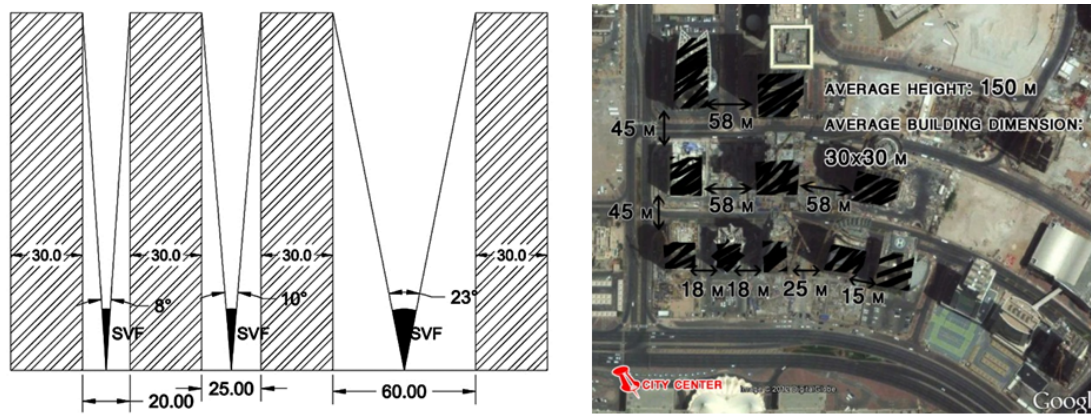


Figure 10. Distances between towers, average heights of towers, and their dimensions.

2- Reduced vegetation in urban areas

Trees and vegetation provide shade, which helps lower surface temperatures. They also help reduce air temperatures through a process called evapotranspiration, in which plants release water to the surrounding air, dissipating ambient heat (Climate Protection Partnership, 2010). As shown in fig.11 the area has a low vegetation cover and trees.

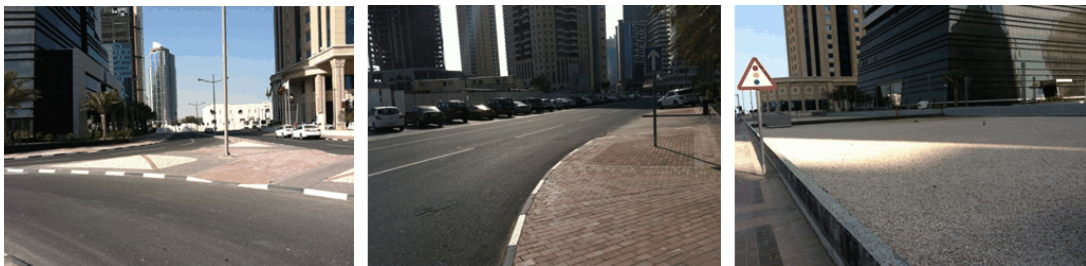


Figure 11. Reduced vegetation in West Bay.

3- Properties of urban materials

The case study is characterized by dry surfaces, such as conventional paved sidewalks, roads, and parking lots. Dark surfaces as asphalt used in parking lots and streets has a low solar reflectance which is the ability of the material to reflect solar rays. This leads to the absorption of heat through the day and the formation of the Urban heat Island. Also, the building materials has a significant influence on the microclimate of the area under study as steel buildings have higher heat capacity than other materials.

4- Weather

As shown in fig.12, it is likely for Doha to formulate Urban heat Island in the months of August, September, and October. Those months are characterized with low wind speed and partially cloudy sky. These features highly contributes to the formulation of the Urban Heat Island.

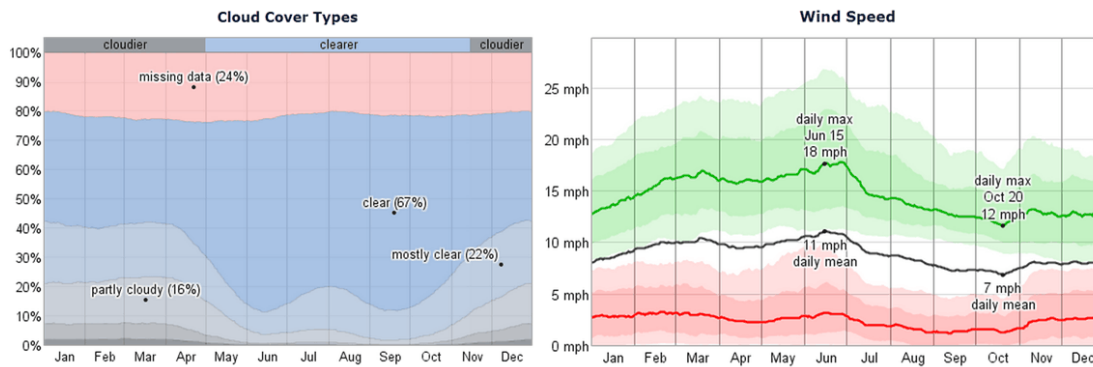


Figure 12. Doha's wind speed and cloud cover. (Weather Spark, 2012)

Impacts of Urban Heat Island UHI- Research results:

Effects of UHI on the environment

- **Energy Consumption:** high temperature in summer increases energy demand for cooling and add pressure on the electricity specially during peak. The united states environmental protection agency (EPA), stated that, during this peak urban electric demand increases 1.5 to 2 percent for every 1°F (0.6°C) increase in summertime temperature. Increasing downtown temperatures over the last decades mean that 5 to 10 percent of community demand for electricity is used to compensate for the heat island effect (US-EPA, 2012). During extreme heat events exacerbated by urban heat islands, the demand for cooling can overload systems, resulting in rolling brownouts or blackouts to avoid power outages.
- **Human Health and Comfort:** increased temperature results in an increase of the surface temperatures, reduced nighttime cooling, and higher air pollution levels associated with urban heat islands. This can affect human health by contributing to general discomfort, respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and heat-related mortality. Sensitive populations, such as children, elders, and those with health conditions are at risk. For example, in 1995, a mid-July heat wave in the Midwest caused more than 1,000 deaths. While it is rare for a heat wave to be so destructive, heat-related mortality is not uncommon. The Centers for Disease Control estimates that from 1979 to 1999, excessive heat exposure contributed to more than 8,000 premature deaths in the United States. This figure exceeds the number of mortalities resulting from hurricanes, lightning, tornadoes, floods, and earthquakes combined. (Climate Protection Partnership, 2010)

Effect of the UHI on Qatar's economy:

- **Increased Electrical Consumption:** Necessarily, the UHI would have an impact on the economy. With increased temperatures due to UHI, the electrical consumption of buildings will increase. This not only exerts a pressure on the environment, but also on the local economy as more resources and capital will be spent on increased usage of electricity in various sectors.
- **Increased Water Consumption.** This is the result of the need to support stressed vegetation and generate the energy required to meet the higher summertime energy demand load. Different sources of energy require

varying amounts of water resources, which are becoming increasingly scarce. (Peck, 2009)

Effect of the UHI on the social life:

- Decreased outdoor activities: The space between buildings is of proper public concern that can help promote sustainable development; improve the quality of the existing environment, and reinforce civic pride and a sense of place. The condition of surroundings has a direct impact on the conservation and improvement of the natural and built environment that brings social and economic benefit for local communities (MAH, 2012). In the case study, the climate is very harsh to hold outdoor activities and events which destroy the social connection that can be established between people in outdoor communities.

Mitigation strategies to reduce Urban Heat Islands

Legislations

Forcing legislation on the buildings height and distance between buildings. These legislation will control the SVF and hence decrease the amount of heat absorbed by the building from adjacent surfaces. Space between buildings should vary according to buildings height.

Green Roof

Vegetated roofs are known from thousands of years. They were used for winter insulation and summer cooling. Nowadays further studies have been done to increase the efficiency of this roofs and improve their performance. Modern lightweight green roofs emerged from research and development work centered in Germany in the 1960s and '70s. Almost all green roofs include layers that work together. Green roof layers include the following elements: High-quality waterproofing- Waterproof membrane protection layer- Root repellent system- Drainage layer- Filter cloth or fabric- Engineered growing media- Plants (Peck, 2009).

Green roofs are more effective than conventional and white roofs for cooling buildings because they utilize a heat-transfer mechanism known as evaporative cooling, which is unavailable to most conventional roofs. Vegetation utilizes incoming solar radiation for evaporating moisture from the plants and the growing media around it, as well as for transpiration during the process of photosynthesis. Conventional roof surfaces are designed to shed water, and thus are unable to accomplish much evaporative cooling. (Peck, 2009)

Cool pavement

Interest in cool pavements has been growing, and an emerging body of research and pilot projects are helping scientists, engineers, and practitioners to understand the interactions between pavements and the urban climate (Climate Protection Partnership, 2010). Cool pavement strategies seek to control the temperature of the pavement (and hence its ability to transfer heat to the air above) by controlling one or more of the material properties that influence the way pavements absorb, store, and radiate heat. These include:

- **Albedo or solar reflectance:** represents the ability of a surface to reflect solar radiation. Albedo is correlated with color, where lighter colors have higher albedos.
- **Permeability:** By allowing water and water vapor to pass through them (or be stored within the voids of the pavement), permeable (or pervious) pavements can take advantage of the cooling effect of evaporation.
- **Conductivity:** This measures the rate at which heat is transferred throughout the pavement. A pavement with low conductivity will get hot at the surface quickly but will not store as much heat as one with higher conductivity.
- **Emissivity:** Emissivity is a measure of the rate at which an object can radiate away heat from its surface; objects with higher emissivity will radiate heat away faster. (Cambridge Systematics, 2005)

Increase vegetation and shading trees

Trees and other plants help cool the environment, making vegetation a simple and effective way to reduce urban heat islands. Trees and vegetation lower surface and air temperatures by providing shade and through evapotranspiration. Trees and vegetation are most useful as a mitigation strategy when planted in strategic locations around buildings or to shade pavement in parking lots and on streets. Researchers have found that planting deciduous trees or vines to the west is typically most effective for cooling a building, especially if they shade windows and part of the building's roof (US-EPA, 2012). The use of trees and vegetation in the urban environment helps in reducing energy use and improve air quality.

Conclusion

The study of urban design morphology and climate reveal that there is a correlation between both. An innovative and serious study of both and their reciprocal relations should lead to significant improvement of the urban thermal performance. To achieve this goal, the comprehensive study of the climate elements such as behavior, wind, temperature, and relative humidity is essential. The implementation of the old town style that is more suitable for the local conditions is a very hard task. Although, some features could be translated in a more modern way to benefit its impact on the environment. This study could be further developed by in-depth experiments to monitor environmental behavior during different times of the year. Also, it can be done in different places that have different settings to determine which of the mitigation strategies are more powerful in the prevention of the formulation of UHI. Green Roof and Cool Pavement are emerging strategies that also need further study to find more solutions to encourage people using it.

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State-of-the-art review of the environmental consequences of steel used for buildings

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Abstract

This paper reviews the sustainable use of steel for building structural frames. Although this literature-based state-of-the-art assessment is a self-contained paper, its purpose is to inform a larger piece of research on the environmental impact of steel. The current carbon emission levels are introduced followed by a detailed review of the environmental impact of each stage of the steel life cycle. The paper has highlighted that steelmaking is the most carbon and energy-intensive phase in the manufacturing process. However, the superior strength-weight ratio and recyclability characteristics make steel a sustainable construction material on the whole. A significant amount of research is underway in the steelmaking industry but the efforts of downstream processes are not well co-ordinated, resulting in numerous gaps in existing environmental data. This paper has recommended that further research be undertaken downstream of the steelmaking phase, focusing on the fabrication phase where records start to disintegrate.

Keywords

Carbon, Construction, Environmental, Steel, Sustainable

1 Introduction

This paper is a literature-based state-of-the-art review of the sustainable use of primary steel in the building industry. It is part of a larger piece of investigation on the green credentials of steel as a building material. Carbon emissions and the sustainable use of natural resources are the main environmental matters discussed.

The objective of this research is to understand the source of embodied carbon emitted in each process of primary steel production and use in buildings, enabling the effective management of steel carbon footprint by directing efforts to hotspots that have the most impact. Although worldwide steelmaking processes have been reviewed in this paper, the United Kingdom (UK) market has been targeted for the physical investigations proposed for the main research.

Current emission levels are discussed first in Section 2 followed by a detailed review of the environmental impact of each stage of steel production, manufacture and use. The stages reviewed include mining, steelmaking, fabrication, construction, operation, maintenance, and end-of-life. Section 3 provides a

recommendation on further research required in the fabrication to end-of-life phase, where environmental data is not clearly defined and co-ordinated.

The larger piece of research that this paper will inform involves a closer look at the building level assessment methods to ensure that the correct methodology is being employed for steelwork structures. A compilation of an inventory of environmental data for the UK building industry will then follow, based on existing databases and data to be collected from the industry. Finally typical environmental profiles for different structural arrangements, to be utilised at project inception stages, will be established.

2 Sustainability of Steel

The production and use of steel contribute to the global environmental challenges of climate change and depleting natural resources. The world population is increasing year on year, resulting in more urbanisation and environmental degradation. Conversely, steel continues to contribute to a sustainable society through the provision of employment and adequate housing. At present, the steel industry directly or indirectly employs over 2 million people worldwide (Worldsteel, 2012).

Although the manufacture of steel produces significant emissions, it has been established that the downstream processes emit relatively small quantities of greenhouse gases (GHG). This, together with high material efficiency and recyclability, makes steel an environmentally-friendly structural material on the whole (Worldsteel, 2012).

Ashby (2009, cited in Allwood & Cullen, 2012) has shown that the only real substitute for steel as a construction material is concrete. However, concrete is only strong in compression and needs steel reinforcement in its tension zones. Furthermore, concrete cannot be used outside the construction industry. Consequently, steel production and use is predicted to double as the world population is estimated to reach 9 billion by 2050.

Can the “the best of both worlds” of minimising emissions and maximising benefits be achieved? Of course, no-one can predict the future with certainty, but understanding past and current patterns through constant review of steel production and use helps to estimate future demand and emissions.

At present, the iron and steel industry emits approximately 35% of the industrial sector and 7% of the global greenhouse gases, of which 93% is carbon dioxide. Based on the production share of the three main methods of blast furnace-basic oxygen furnace (BF-BOF), electric arc furnace (EAF) and open hearth furnace (OHF), the weighted average emission is 1.8kg of CO₂ for every kilogram of steel produced (Worldsteel, 2012). Table 1 shows the approximate emission breakdown for each steel production process.

Table 1. Emissions estimates per unit processed for major steel production processes (Allwood & Cullen, 2012)

Process	Emissions (kgCO₂/kg)
Iron making - blast furnace	0.5
Coking	0.2
Sintering	0.4
Direct reduction	1.2
Steelmaking – oxygen blown furnace	0.2
Steelmaking – electric arc furnace	0.5
Scrap preparation	0.01
Steelmaking – open hearth furnace	1.0
Continuous casting	0.01
Ingot casting	0.05
Hot strip milling	0.1
Cold strip milling	0.4
Plate mill	0.1
Rod and bar mill	0.2
Section mill	0.2
Galvanising plant	0.2
Tinning mill	0.04
Extrusion	0.2
Primary mill	0.1
Forming	0.1
Steel product casting	2.4
Iron foundry casting	1.7
Fabrication	1.0

The absolute emissions are estimated at 2GtCO₂/year for making liquid steel only, 2.5GtCO₂/year for stock products and 3.5GtCO₂/year for final products (Allwood & Cullen, 2012). In spite of an increased fraction of recycled metal over the years, these GHG emissions are predicted to double by 2050.

The majority of the emissions in the manufacture and use of steel are related to the energy required to process the material. A combination of primary and secondary energy is required for the mining and steelmaking phases, but downstream processes mainly use electricity. The energy needs depend on the production route and number of processes involved. Downstream of the steelmaking process, the records are not accurately maintained and individual companies are reluctant to share information that may be commercially sensitive (Allwood & Cullen, 2012).

Emissions are rarely measured in practice and often published figures are deduced from experimental investigations. These emissions are from chemical reactions in the reduction of ores to liquid metal, directly from fuel combustion and indirectly from electricity generation. The first two emissions can be calculated from the quantities of material and primary fuel involved in the process. The third,

electricity, is a direct energy which needs to be linked back to the primary energy source such as coal, as this is the source of carbon emissions (Allwood & Cullen, 2012).

Since there is no real substitute for steel, the only practical solution is to continue improving the current processes and developing innovative solutions that reduce emissions and energy consumption. A logical starting point is an in-depth understanding of the lifecycle of steel shown in Figure 1.

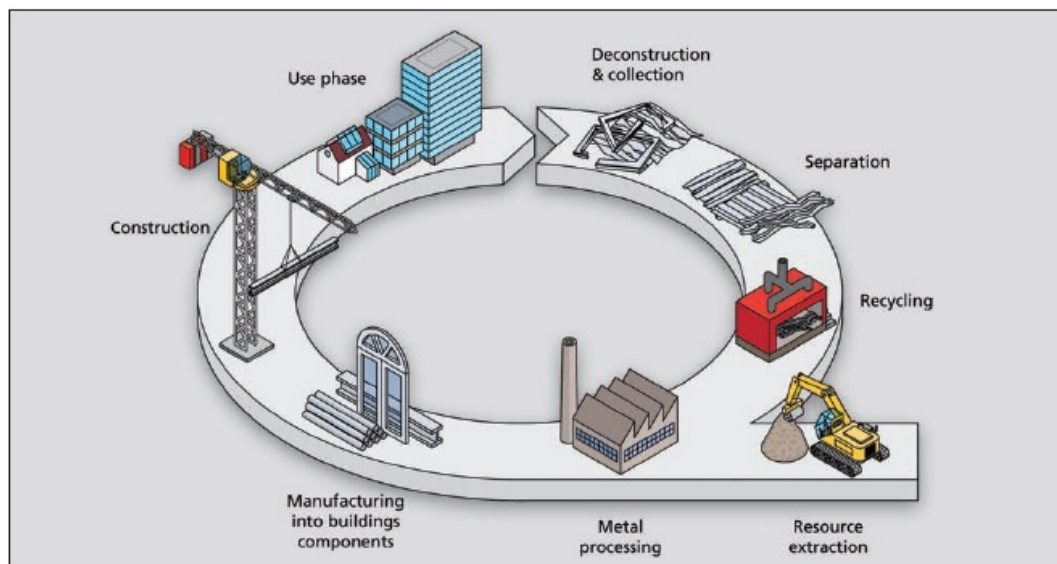


Fig. 1. The life cycle of steel (Metals for Buildings, 2011)

2.1 Mining

Iron ore, coal, limestone, gas and electricity are the main resources required to make steel. Iron is a chemical element that, because of its natural affinity for oxygen, appears naturally in the form of iron oxide. The most common forms of iron oxide are haematite and magnetite, which both have low metallic concentration such that ores consisting of a quarter of pure iron are considered to be of good quality. The extracted rock is crushed first and the iron ore separated from the quartz by use of magnets for magnetite and floatation for haematite (Worldsteel, 2011a).

A tonne of steel requires much more than a tonne of feedstock material, with the majority of impurities removed during the steelmaking process. Furthermore, to yield a tonne of ore typically requires 10 tonnes of the rock to be extracted. The band of iron sand is usually not on the ground surface and so much more land stress and environmental degradation occurs during the mining process (Allwood & Cullen, 2012).

Iron ore is one of the earth's most abundant materials but clearly at the current consumption rate the world will eventually run out of this natural resource. The current operations are targeting the best deposits in terms of quality and ease of extraction. Future ore deposits will be less convenient and may lead to more energy required and carbon emitted during their extraction.

The uneven geographical distribution of iron ore has adverse environmental and economic impacts on steel production. For instance, cheap hydro-electricity is largely available in Canada, while iron ore is abundant in Australia. Thus, raw materials are either being transported long distances or a more carbon-intensive power supply is being used to process them. Currently China acquires the majority of its imported iron ore from Australia. In future, this uneven distribution of iron ore may cause political conflicts as the resource starts to deplete (Allwood & Cullen, 2012).

The mining stage emits greenhouse gases through the combustion of fuels used by the mining equipment and for the transportation of the ores. The extraction process requires the use of chemicals some of which are harmful. Some of the material production processes are water intensive and, depending on the location of the mining site, may cause local water stress (Worldsteel, 2011a).

2.2 Steel production

The steel industry makes liquid steel from ores and recycled steel and casts it into stock products. The major impacts of the steel manufacturing process are the use of virgin materials and energy, which results in the emission of greenhouse gases. The materials include iron ore, coal, limestone and recycled steel but traces of other materials are added to vary the steel composition and remove impurities. The main emissions include carbon dioxide, sulphur oxides, nitrogen oxides and dust (Allwood & Cullen, 2012).

Over the years, the steelmaking industry has developed technology that uses raw materials efficiently. According to Worldsteel (2011a), a tonne of crude steel produced through the BF-BOF route requires 1.4 tonnes of iron ore, 0.8 tonnes of coal, 0.3 tonnes of limestone and 0.12 tonnes of recycled steel. The EAF typically requires a 0.88 tonnes of recycled steel, 0.016 tonnes of coal and 0.064 tonnes of limestone to produce a tonne of crude steel.

Converting iron ore into steel is an energy-intensive process, especially the liquid metal phase. Energy is required to melt the materials in order to facilitate casting into different shapes, to energise the atoms leading to diffusion and to encourage chemical reactions between atoms (Allwood & Cullen, 2012).

Owing to well-established international standards, steel products from different steel mills cannot be easily distinguished and so consumers have the freedom to buy the cheapest stock on the market. Thus, it is difficult for the steel mills to dictate the selling price of their stock, although they can control costs. With energy use accounting for up to 40% of operating costs (APPCDC, 2010), this has been the principle cost-cutting initiative in the industry for years as highlighted in Figure 2 below. The graph shows that, on average, energy consumption has been halved over the past 35 years.

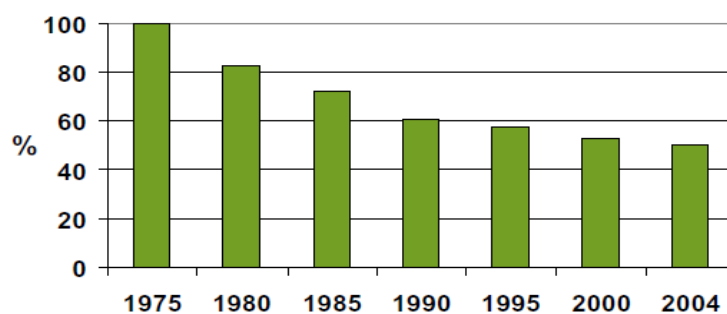


Fig. 2. Indexed energy consumption/t crude steel produced in North America, Japan and Europe (1975 = 100%) (Worldsteel, 2008)

Gibbs (cited in Allwood & Cullen, 2012) has shown that the theoretical minimum energy for an ideal steelmaking process from ore is 6.7GJ per tonne of liquid metal. A current best practice of about twice this absolute limit demonstrates the maturity of the steelmaking technology. The savings are realised through process efficiency, improvements in electricity generation and developments in technology.

The high temperatures involved in steelmaking mean that intricate cooling techniques are necessary. About 80% of water used in steelmaking is for once-through cooling and the remaining amount is used for cleaning and cooling other areas of the process, as well as in heat processing equipment. Sea water is preferred as it can be returned to the source with no change in quality but this depends primarily on availability and national legislation. Water consumption is very low and recycling rates of up to 98% in advanced technologies are possible, with the main losses being through evaporation (SCI, 2003).

Emissions into the air are also monitored by the industry, enabling process improvements to be investigated and implemented. Some of the control methods include dust suppression, thermal oxidation, chemical treatment, scrubber and filtration systems (SCI, 2003).

Considering that extensive research and marked progress has been made over the years, can the environmental footprint of the steelmaking process be reduced any further? The parameters for an efficient furnace have been long established and these include using pure oxygen instead of air, increasing capacity to benefit from economies of scale, continuous operation of furnaces to minimise stabilisation energy, properly sealed and insulated furnaces to reduce heat losses, maintaining the optimum air-fuel ratio, heat recovery from exhaust gases and better programming and control of processes (Allwood & Cullen, 2012).

The answer, however, is a resounding yes! Although advanced technologies are now very efficient, steelmaking companies are at different maturity levels. The average energy consumption in primary steel production is estimated as 25GJ/tonne (Allwood & Cullen, 2012), which is more than double that of the current best practice. There are still significant improvements to be brought to some sites through technology transfer and sharing of best practice to achieve optimum operating levels.

Most of the CO₂ is generated by the ore reduction process within the blast furnace as a result of the chemical reaction between the iron ore and coke. Whilst coke cannot be completely substituted because of the structural role it serves in the BF, there is already replacement, by pulverized coal or natural gas, of up to 50% in some applications (SCI, 2003).

Furthermore, there has been large-scale research in low-carbon technologies across the globe. These programmes include the EU's ULCOS (ultra-low CO₂ steelmaking) and Japan's Course 50. Other programmes, largely sponsored by the steelmaking industry, are taking place in the USA, Canada, South America, South Korea, China and Australia. Technologies that reduce GHG emissions by 50% have been identified and a number of experiments are now in the feasibility stages (Worldsteel, 2009).

2.3 Fabrication

The stock products from the steelmaking industry are processed into final products through fabrication. The processes involved include cutting, drilling, forming and joining into the final form. Unlike the steelmaking industry, where environmental data is managed by the Worldsteel LCA forum, data collected from this stage onwards is no longer co-ordinated and, therefore, there is lack of consistency and gaps in existing knowledge (Worldsteel, 2011b).

The energy use in this phase mainly depends on the number of processes involved. For instance, very few processes are involved with the Universal Beam (UB) and these could just be rolling into shape, cutting to length and welding end plates for connections (Allwood & Cullen, 2012).

UK fabricators have made significant investments in 3D modelling technologies with direct links to Computer Numerical Control (CNC) machines. Further investment in associated IT software has facilitated the transfer of information between fabrication and construction (SCI, 2003). Added value includes the sharing of methods of working that minimise emissions and waste as well as maximising the time available for the refinement of the design.

Apparently, more scrap metal is collected during fabrication than at the end-of-life of the steel product. Pre-consumer scrap is of high value because it is of known composition and can be separated in the workshop and recycled directly into steel of an equivalent grade (Worldsteel, 2012). However, the production of this much waste before the product even leaves the factory needs to be investigated and linked back to the design stage to see if the specification of standard lengths that align with stock products can improve the situation.

There is need for research to be undertaken on energy consumption and GHG emissions at this fabrication stage. Do the cost and emissions decrease as the volume of steel processed by the factory increases? It is worth investigating the optimum volume of steel that each factory can handle in order to minimise emissions.

2.4 Transport

There are different forms of transport that link the various phases of a product's life. For steel, these include the link between mining, steelmaking, fabrication, construction site, scrap yard and back to steelmaking yard. However, the stage that is often-ignored in environmental assessments is the factory gate to the construction site phase, which needs to be explored further together with its relationship to the fabricators.

On average, transport contributes to less than 7% of the cradle-to-site embodied carbon emissions although this figure is higher for materials that require low processing energy such as concrete aggregates (Hammond & Jones, 2011). The unit for transport impact on GHG emissions is tonne kilometre (tkm), which is the effect of transporting a tonne of material over a distance of one kilometre. Consideration should be given to whether return trips are empty or not. In general, road transport has a larger impact than sea or rail.

2.5 Construction

Steel offers the safest construction material because the components are prefabricated in a controlled factory environment. Assembling the steel frame into its final shape and form usually needs very few components to be adjusted. The erection process requires a small number of skilled personnel and involves minimal handling operations that are potentially dangerous (Worldsteel, 2012).

Steel frames involve fast, clean and quiet construction, thereby providing earlier weatherproofing for follow-on trades on site and reducing the overall cost. Waste disposed of in landfill, disruptions to neighbouring communities, noise and dust pollution can be controlled owing to the fabrication process being carried out under factory conditions (SCI, 2003).

According to Smart Waste (cited in Hammond & Jones, 2011), up to 22m³ of waste is generated for every 100m² of floor area during the construction process. This amount of waste needs to be considered in the embodied carbon assessments. Waste from structural steel, if any, will be generated by design and construction errors as well as over-ordering by contractors.

2.6 Operation and Maintenance

Steelwork occasionally needs corrosion and fire protection. With the right specification, steel structures can have a long service life without the need for periodic maintenance. UK buildings are generally designed for 60 years but in reality, this life expectancy can be surpassed by a large margin when adequate surface treatment and proper maintenance is provided (SCI, 2003).

Although operation carbon emissions are not investigated as part of this paper, steel helps to construct low carbon buildings that are energy efficient. Good cross ventilation in buildings can reduce the need for mechanical air conditioning. With the correct building layout and structural arrangement, passive solar heating and natural lighting can be maximised during operation (DEW, 2007).

By employing adequate design considerations, lightweight partitions can be moved around during service without affecting the structural integrity of a building. Furthermore, the lightweight nature of steel structures often allows alterations to be carried out on the superstructure without overloading existing foundations. Where the structural elements need to be replaced, these can be taken apart and rebuilt discreetly with minimal dust emissions (SCI, 2003).

2.7 *Re-use*

Re-use is the best form of recycling and is preferred because no energy-intensive reprocessing operation is necessary. Furthermore, valuable virgin materials are conserved and potential waste is diverted away from landfill. Fittingly, the durability of steel allows many of its products to be used over and over again, thereby reducing GHG emissions. According to Allwood & Cullen (2012), building re-use can save up to 1.5kgCO₂ emissions for every kg of steel.

A steel frame is conceptually a kit of prefabricated beam and column components that are delivered to site for final assembly. Modern buildings are designed for de-assembly, enabling subsequent re-use of building components. With improvements in standardisation and optimum use of materials, re-use of steel frames in UK can be increased from the current 5% estimate (Tata Steel & BCSA, 2012).

The majority of companies involved in the re-use of structural steel downgrade the material strength to the lowest possible in order to avoid the inconvenient verification processes (Allwood & Cullen, 2012). More effort is still required to promote consumer confidence in re-used steel buildings and their components.

2.8 *End-of-life: Recycling and Waste*

Even after several re-uses and an extended life, a steel building will eventually need to be decommissioned. Steel can undergo several lifetimes with no detrimental effect on quality owing to the current recycling method of melting, casting and rolling. Approximately 50% of world steel production is from recyclable sources (Allwood & Cullen, 2012).

Waste is defined as any steel and its by-products that are not recovered and either find their way to landfill sites or remain in the ground as contaminants. The 100% recyclability of steel implies that it can only become waste due to lack of proper recovery measures (Worldsteel, 2012).

Steel is recovered more than any other construction material in the UK with rates of 99% for all structural steel and 94% of steel construction products (Tata Steel & BCSA, 2012). The average global recovery rate is approximately 85% at present. This high recovery rate of scrap steel is driven by the monetary value brought about by an established worldwide market.

Magnetic separation can facilitate total recovery of steel at end-of-life. Technology to separate waste by alloy type already exists, but a lot of effort is still required to make it commercially viable for businesses. However, Ayres (2006, cited in Allwood & Cullen, 2012) predicts that a steel recycling rate of 90% should be the

maximum in order to allow a margin for improvement and avoid creating an environmental burden whereby other users of scrap metal are forced to use virgin steel.

Substructure steel recovery rates are slightly less than those possible and, therefore, more effort is still required in this area. Steel encased in concrete, steel piles and other below ground steel structures, including reinforcement bars in foundations, are rarely recovered for recycling at end-of-life owing to the high expenses involved (SCI, 2003).

Pre-consumer scrap (excess materials and off-cuts from steel production and fabrication) is fed directly back into the steel production. On the other hand, post-consumer scrap (recovered at the end of a product's life) needs to be prepared by shredding and baling, including the removal of contaminants such as zinc, before it can be recycled back into the furnace. Unknown residual elements derived from scrap metal may have a detrimental effect on the future use of steel with recycled content (SCI, 2003).

The benefit of recovering scrap metal is that it prevents the need for the same quantity of steel to be made from the primary production route. However, allocation of the potential savings should be carefully considered in order to avoid double counting. A good design will strike a balance between the use of recycled material and designing for recyclability. Therefore, a shared benefit between the systems that provide and consume the scrap metal is more appropriate (Hammond & Jones, 2011).

Efficiency is not only found in the recovery rates at the end of the building's life but also in co-product use. According to Worldsteel (2012), steel waste rarely finds its way to landfills and the industry target is zero waste. Worldsteel claims that an average of 98% of raw materials currently being used in the production of crude steel is being converted into useful products or by-products.

The main by-products of the steelmaking process include slag, dust, sludge and gases. These are recycled back into the process or sold under the "industry symbiosis" programme where companies trade in by-products (Allwood & Cullen, 2012).

In modern steelmaking processes, nearly 100% of iron making (blast furnace) slag is recovered. However, the recovery rate of steelmaking (ferro-lime) slag is slightly lower at approximately 80% owing to its high free lime content. Research on the separation of this free lime is underway, which has ready applications in fertilisers and cement production (Worldsteel, 2012).

Clinker, the main ingredient of cement, produces about 0.52 tCO₂ emissions per tonne of the material. In the UK, ground granulated blast furnace slag (GGBS) can be used to replace up to 85% of normal cement in concrete. Supplies of GGBS in the UK can be limited and this by-product is rarely disposed of on waste sites. Although concrete with GGBS suffers from a slightly longer setting time and an increased rate of carbonation, it benefits from a considerably low carbon footprint

and reduced heat of hydration. Slag is also used as a substitute for primary aggregates in construction (Hammond & Jones, 2011).

Exhaust gases contain 80% of chemical energy lost from the furnace. These gases can be captured, cleaned and combusted to recover the energy through innovative technologies such as the Carbon Capture and Storage (CCS) system. The recycled energy can be used as fuel in the furnace and other downstream processes or for heating up the coke-making ovens, thereby reducing the need for primary energy. Research on the capture of hydrogen from coke gas is also underway (Worldsteel, 2008).

Whilst the dust and sludge are fed back into the steelmaking process, the iron oxides are sold for the manufacture of electric motor cores and cementitious products. Zinc oxides from the EAF and coke oven gas from the BF-BOF are raw materials that are sold to the fertilisers and plastics industries (Worldsteel, 2012).

3 Recommendation

The paper has established that steelmaking is a very mature industry with research on carbon footprint improvements well-funded and underway. In spite of the low emissions produced downstream of the liquid metal phase, it is important that efficiency in every process of the steel life cycle is improved if the requirements of the UK Climate Change Act are to be met.

It is therefore vital to identify the environmental impact hotspots in the steel processes downstream of the steelmaking phase and understand the precursors of the GHG emissions at each stage, thereby providing the background information necessary to propose a robust strategy to carbon footprint improvement. Several of UK steel fabricators are already collecting data under the “corporate social responsibility” banner but there is need to encourage those that are not and co-ordinate the efforts of those already involved. The areas that require further investigation can be categorised as:

1. Material sourcing, certification and transportation;
2. Re-use, recycling and waste management;
3. Energy source and monitoring and;
4. General and resource management.

This research will assist UK fabricators to understand the drivers of their energy consumption, provide guidance to their workforce in the collection of environmental data, and perhaps establish the optimum operating capacity of each participating company. This data collection process should be set up in a manner that enables voluntary periodic updates by the fabricators, even years after the research has been completed. In addition, ways of linking this database to the UK Steel and Worldsteel LCI data need to be investigated further.

4 Conclusion

Sustainable practices discourage irresponsible use of natural resources and emission of GHG into the atmosphere. However, these environmental issues need to be

considered in conjunction with economic and social impacts. Steel material costs is a very small proportion of the final value of a building, with the rest of the money from the sale of the end product paying for the wages of millions of people that the industry employs across the globe. As such, the environmental impact caused by steel manufacture may be outweighed by the social and economic benefits that it provides. Clearly, there is no real substitute for steel at present and, therefore, the reduction in GHG emissions can only come from improvements to the production, manufacturing, design, construction and recycling processes.

Steel itself is a durable material whose products often outlive their design life. In the UK, steel is recovered more than any other construction material and can be re-used with minimum further processing. Scrap metal and other steel by-products have a well-established market worldwide, which helps to minimise the primary extraction of non-renewable resources, reduce GHG emissions and divert waste away from landfills.

Considering the significant amount of co-ordinated research in the steelmaking industry, this paper suggests that environmental data be gathered from UK steel fabricators to complement that in existence and help create a complete inventory for the UK industry. Providing easy access to user-friendly databases will encourage a wider embracing of sustainable development in the built environment.

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Construction Quality and Knowledge Communication in Post-disaster Reconstruction Projects

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Abstract

Reconstruction following disasters plays an important role in the recovery phase of disaster management. The reconstruction process provides an opportunity for a given society to develop safer houses and infrastructure in such a manner that they can act as structural mitigation and preparation for the any further disasters. This implies that construction quality has to be properly addressed in the reconstruction phase. Reconstruction following a disaster, however, is probably more challenging when compared to ‘normal’ construction activity, due to the difficult environmental conditions usually encountered in the aftermath of a disaster. Thus, delivering the desired quality in the finished project during the reconstruction phase becomes a daunting task. Previous studies also posit the inherent difficulty of achieving the desired quality levels in post-disaster reconstruction efforts. This paper, which forms part of an on-going PhD research, seeks to investigate the role of knowledge communication in post-disaster reconstruction projects in Indonesia. It investigates construction quality implementation approaches in post-disaster reconstruction projects in Indonesia, especially concerning the relationship between achieving the desired quality and knowledge communication implementation. The paper adopts a mixed research method; analysing 143 useable questionnaires and 33 interviews from post-disaster reconstruction stakeholders in Indonesia. Preliminary findings reveal that achieving planned construction quality is considered to be the most challenging aspect in post-disaster reconstruction. Completion of the project to the specified quality is also perceived as the most important project success criterion. Lessons for academia and for project managers are proffered in the paper.

Keywords

Construction quality, Indonesia, knowledge communication, post-disaster reconstruction

Introduction

The profile of Indonesia shows that the country is very vulnerable to disasters. Indonesia is located on a ‘ring of fire’ of active volcanoes and tectonic plates. The population of Indonesia was more than 237.5 million in 2010, and has grown by more than 32% compared to the census taken in 1990 (BPS, 2011). More than 80% of areas, 383 out of 471 districts and cities, are considered to be disaster prone (Hadi, 2009a). Indonesia was also ranked first in human exposure to disasters during the tsunami and landslide (Preventionweb, 2010).

According to the international database, the ‘Centre for Research on the Epidemiology of Disasters (CRED), in the last 20 years Indonesian disasters have

been dominated by floods, earthquakes and landslides. Meanwhile earthquakes, wildfires and droughts were the three events that most affected Indonesian inhabitants with six out of ten of the most deadly disasters in that period being earthquakes (EM-DAT, 2012).

It is clearly seen from the database that earthquakes are the most prominent disasters in Indonesia. Irsyam et al. (2010) calculated that in Indonesia, in the period between 1987-2009, more than 14,000 earthquakes occurred with a magnitude of $M > 5.0$. Large earthquakes in the last six years consisted of the 2004 Aceh earthquake and tsunami ($M_w = 9.2$), the 2005 Nias earthquake ($M_w = 8.7$), the 2006 Jogjakarta earthquake ($M_w = 6.3$), the 2009 Tasikmalaya earthquake ($M_w = 7.4$) and the 2009 Padang earthquake ($M_w = 7.6$) (Irsyam et al, 2010). Losses from these earthquakes encompassed not only human lives but also damage to housing and infrastructure. In the 2004 Aceh earthquake, 120,000 houses were damaged, with 306,234 and 13,577 houses damaged in the 2006 Yogyakarta and 2007 Bengkulu earthquake, respectively (Hadi, 2009b). More recently, the 2010 Padang earthquake caused 114,797 houses to be damaged.

With regard to disaster management, most of the authors (e.g., Alexander, 2002, Perera et al., 2010) identify four key stages in disaster management: response, recovery, mitigation and preparedness. Reconstruction is an activity carried out in the recovery phase and plays an important role in disaster management. Following a disaster, the restoration of livelihoods for individuals in disaster affected communities is restored by building new housing units and infrastructure. It is an opportunity to re-plan the community, beginning a new life with a new start. Previous living conditions can be restored, and often, may result in better living conditions after reconstruction.

In the disaster cycle, reconstruction is also the key for mitigation and preparedness for future disasters by the application of structural measures and non-structural measures. The quality of the housing and infrastructure constructed during the reconstruction phase will influence the vulnerability of communities to future disasters. The reconstruction phase provides an opportunity to begin again and 'do it right' to accomplish hazard reduction goals and also objectives of land planning and economic development (Boen, 2006).

The reconstruction following the 2004 tsunami was conducted using the 'build back better' framework (BRR, 2005, United Nation, 2006) which aims to create better conditions following a disaster. However, Kennedy et al., (2008) criticised the use of the word 'better' in the tag 'build back better', which, according to their research, can have many interpretations. Furthermore, Kennedy et al., suggests that a more appropriate term is 'safer' which implies the use of better reconstruction methods to mitigate the devastation of future disasters.

This paper aims to highlight the importance of construction quality in post-disaster reconstruction projects and the role knowledge communication plays in reconstruction projects. The first section of this paper describe disasters occurring in Indonesia and the importance of the reconstruction. It will continue with the quality of recent post-disaster reconstruction projects in Indonesia; and the final section will discuss knowledge communication in post-disaster reconstruction projects.

Construction quality

There are various definitions of quality and the choice of definition used depends on the domain and purpose for its use (Maria and Bártolo, 2000, Battikha, 2003). However, the widely accepted definition of quality in construction is “conformance with requirements” (Davies et al., 1989, Chileshe et al., 1999, Battikha, 2003). The requirement may come from clients’ need or expectation (Battikha, 2003) which is translated into contracts, specifications, drawings, codes and standards (Chileshe et al., 1999). There are costs associated with achieving quality which covers quality-related activities in the form of quality assurance and quality control and requires expenditure of approximately 1 to 5% of a construction project’s total cost (Davies et al., 1989).

Customer satisfaction is a broader concept than quality. Gunning (2000) differentiates customer satisfaction and quality; where customer satisfaction is a value laden phenomenon and dependent on price, whereas service quality is not generally dependent on price. Customer satisfaction is a cumulative experience based on the past, present and anticipated future experience. However, service quality is related to current perception of goods or services. The other distinction of quality is a predecessor of customer satisfaction.

Quality in construction is affected by several factors. Pheng and Ke-Wei (1996) presented ten important factors that can affect quality and three of the most important factors are poor workmanship by contractors, defects in drawings and specifications and more attention paid by contractors to schedules and cost rather than quality in completing projects. Pheng (1997) proposes nine factors that lead to construction quality based on book samurai way by Miyamotho Musashi. These imply that knowledge and skill are needed in an effort to attain good construction quality. Abdel-Razek (1998) identified sixteen factors that are required to improve construction quality in Egypt. Three of the most important factors are improving the design and planning stage during the preconstruction phase, developing and improving quality control and assurance systems, and improving the financial status and standard of living of employees.

Defects in construction may be caused by nature and human error and research undertaken by Pheng and Wee (2001) shows that there are eleven human-error related failings and that three of the main causes are ignorance and lack of knowledge, lack of training and skills and lack of motivation and conscientiousness.

Knowledge communication

Eppler (2007) defines knowledge communication as “*(deliberate) activity of interactively conveying and co-constructing insights, assessments, experiences or skills through verbal and non-verbal means*”. Furthermore he points out that knowledge communication is about the successful transfer of know-how, know-why, know-what, and know-who through face-to-face (collocated) or media-based (virtual) interaction.

Knowledge sharing is a form of communication (Hooff and Ridder, 2004). These authors argue that knowledge transfer involves either actively communicating to others what one knows or actively consulting others in order to learn what they know. Similarly, Liyanage et al., (2009) also suggest that knowledge transfer is an act of communication. They considered knowledge transfer to be the conveyance of knowledge from one place, person or ownership to another. Successful knowledge

transfer means that the transfer of knowledge results in the successful creation and application of knowledge in an organisation

Research methodology

This paper is a part of ongoing PhD research which aims to develop a conceptual model and a set of guidelines for improved awareness and understanding of the role of knowledge communication in effective project management of post-disaster reconstruction projects.

The research employs a mixed method research approach, combining quantitative (questionnaire survey) and qualitative (semi-structured interviews) paradigms and allowing investigation from both an inductive and deductive perspective (Hesse-Biber, 2010, Jogulu and Pansiri, 2011)

Respondents are contractors, consultants, NGOs, and local government organisations who had experience of the Aceh reconstruction, West Sumatra reconstruction and Yogyakarta reconstruction. For the questionnaire survey, 777 questionnaires were distributed and 143 usable questionnaires were returned, which represents a 19.4% response rate. Concurrent with the questionnaire survey, 33 semi-structured interviews have also been conducted with the informants from the previously mentioned 4 organisations. The questionnaire survey data was analysed using SPSS 16.0 software and the semi-structured interview data was analysed using nVivo 9.0 software.

Challenges in post-disaster reconstruction in Indonesia

One of objectives of the present research is to identify the challenges in post-disaster reconstruction projects from the perspective of project management of the construction facility. Using questionnaire surveys, as mentioned in the previous section, research respondents perceived challenges as presented in following Table 1.

Table 1: Challenges in post-disaster reconstruction projects

<i>Challenges</i>	<i>Mean Score</i>				
	<i>ALL (N=143)</i>	<i>CTR (N=47)</i>	<i>NGO (N=36)</i>	<i>GOV (N=34)</i>	<i>CSL (N=26)</i>
<i>Achieving planned construction quality</i>	3.90	3.89	3.44	4.12	4.23
<i>Starting the construction project timely/immediately</i>	3.85	3.85	3.56	4.06	4.00
<i>Avoiding corruption in the reconstruction process</i>	3.83	3.66	3.64	3.88	4.31
<i>Working in limited or poor conditions, facilities and infrastructure at the project location.</i>	3.77	3.87	3.39	4.15	3.62
<i>Improving the capacity of local government/agency</i>	3.73	3.66	3.47	3.94	3.92
<i>Dealing with rising costs of materials and labour</i>	3.70	3.83	3.39	3.76	3.81
<i>Having clear accountability in the reconstruction process</i>	3.66	3.70	3.11	4.00	3.92
<i>Having adequate quality inspection of construction work</i>	3.64	3.60	3.19	3.79	4.12
<i>Having clear transparency in processes on the reconstruction project</i>	3.61	3.53	3.17	3.94	3.92
<i>Working with poor or restricted access to location</i>	3.59	3.68	3.19	3.91	3.54
<i>Building construction projects that culturally fit the needs of local people</i>	3.57	3.68	2.94	3.82	3.92

<i>Challenges</i>	<i>Mean Score</i>				
	<i>ALL (N=143)</i>	<i>CTR (N=47)</i>	<i>NGO (N=36)</i>	<i>GOV (N=34)</i>	<i>CSL (N=26)</i>
<i>Establishing property rights</i>	3.52	3.21	3.39	3.85	3.85
<i>Finding suitable land/location for the reconstruction project</i>	3.43	3.40	3.06	3.68	3.69
<i>Minimising the negative effects of political instability</i>	3.42	3.47	2.94	3.88	3.38
<i>To have good coordination with other stakeholders/parties</i>	3.35	2.89	3.64	3.47	3.62
<i>Improving information and communication processes</i>	3.34	3.06	3.08	3.71	3.73
<i>Securing finance for the reconstruction project</i>	3.30	3.11	3.00	3.71	3.54
<i>Securing adequate resources (material and machinery)</i>	3.27	3.23	3.39	2.97	3.54
<i>Following regulations related to the reconstruction</i>	3.25	3.43	2.72	3.32	3.58
<i>Putting in place an appropriate organisation structure</i>	3.23	3.11	2.83	3.50	3.65
<i>Securing an adequate labour force</i>	3.20	3.06	3.22	3.06	3.58
<i>The scale: 1 (Not challenging at all), 2 (Less challenging), 3 (Fairly challenging), 4 (Challenging), 5 (Very challenging); ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants</i>					

Table 2: Success criteria for reconstruction projects

<i>Success Criteria</i>	<i>Mean Score</i>				
	<i>ALL (N=143)</i>	<i>CTR (N=47)</i>	<i>NGO (N=36)</i>	<i>GOV (N=34)</i>	<i>CSL (N=26)</i>
<i>Completion of reconstruction project within specified quality</i>	4.65	4.79	4.36	4.74	4.69
<i>Meet health and safety standard</i>	4.59	4.66	4.47	4.71	4.46
<i>Completion of reconstruction project within the budgeted cost</i>	4.55	4.55	4.33	4.76	4.54
<i>Completion of reconstruction project within the allocated time period</i>	4.49	4.68	4.06	4.68	4.50
<i>End user (disaster victims) satisfaction with final product</i>	4.48	4.55	4.56	4.56	4.15
<i>End user (disaster victims) satisfaction with reconstruction process</i>	4.41	4.55	4.36	4.47	4.15
<i>Stakeholders satisfaction</i>	4.36	4.45	4.22	4.50	4.23
<i>Minimum disputes and conflicts between stakeholders</i>	4.08	3.85	4.22	4.24	4.12
<i>The scale: 1 (Not important at all), 2 (Less important), 3 (Fairly important), 4 (Important), 5 (Very important). ALL = Overall, CTR = Contractors, NGO = NGOs, GOV = Governments, CSL = Consultants</i>					

As can be seen in the table, achieving planned construction quality is rated by the respondents as the most challenging in reconstruction projects. However, further examination of the table shows that there are different views held by groups of respondents on achieving construction quality. The contractors rated ‘achieving construction quality’ as number 1, but respondents from NGOs, governments and consultants rated this stance at number 5, 2 and 2 respectively.

The Kruskal-Wallis test is conducted to confirm that different views are held between the groups of respondents and the results show that, statistically, different views are apparent between the groups. Interestingly, in a further test to see what

the difference amounts to, the Mann-Whitney test was used and showed that NGOs have a different view compared to the other groups. The results imply that the NGOs consider achieving quality is not as difficult as the other groups suggest.

In terms of the criteria for project success, the questionnaire survey reveals the results as presented in Table 2. Meeting the specified quality is considered to be the most important criterion for success of post-disaster reconstruction projects. Further examination of Table 2 shows that respondents from NGOs view disaster victims' satisfaction as the most important success criterion and, furthermore, the Kruskal-Wallis test reveals that NGOs hold different views relating to 'the golden triangle' (cost, time, and quality).

Construction quality in the reconstruction projects

Table and Table show that quality is the main challenge in post-disaster reconstruction projects. However, reconstruction projects often consist of a large number of structures to be built in a limited time, so quality of construction may be overlooked in order to achieve timely completion with limited resources and construction workers.

Research by Pribadi and Soemardi (1996) reveals other contributors to lack of quality in reconstruction work: incompleteness of detailed drawings that may lead to misinterpretation by contractor/tradesmen, unsuitable local materials, difficult terrain and climate and local tradesmen's lack of skills. .

In case of the Aceh reconstruction, Pribadi et al. (2008) imply that there are three sources that may lead to poor achievement of reconstruction quality. Firstly, using poor quality materials may lead to poor quality work. They gave examples of poor grade sand and gravels that were obtained directly from the river. Secondly, poor workmanship also contributes to poor quality work. Construction workers were limited and traditionally they learn about construction processes from previous generations. Thirdly, lack of qualified, quality inspectors and large numbers of projects being undertaken at the same time made quality inspection and control difficult to manage.

With regard to the quality materials, Soemardi (2007) found several aspects contributed to poor quality work in relation to sub-standard materials (aggregates, bricks, reinforcement bar diameter) and mistakes in executing works, such as using excessive water in concrete mix.

Since most construction workers in Indonesia learn their skills from previous generations of workers, they rarely follow specifications for building earthquake resistance into housing construction. They have poor knowledge of earthquake resistant housing design and have learned 'false standards' which they then implement as the correct standards (Suarjana and Sengara, 2008). NGOs initiated their own guidelines and manuals for earthquake resistant housing, and neglected to make use of building codes instigated by the government (Steinberg, 2007). The agencies also brought new materials and technologies (Chang et al., 2011) which may have made it more difficult to achieve the specified quality.

The Indonesian building code which relates to post-earthquakes reconstruction is the Indonesian seismic design code SNI.03-1726-2002 (Badan Standardisasi Nasional (BSN), 2001). This code contains a methodology for designing structures which can withstand the force of earthquakes, and which also includes an

Indonesian seismic map. However, it is considered that the scope of the code excludes single storey residential housing. So, following the Aceh earthquake the Ministry of Public Works (PU) published the Building Code for Aceh which covers single storey residential housing (PU, 2006). These guidelines cover design and technical requirements for residential housing, including building type, minimum size for the house, minimum column and beam dimension, minimum quantity for reinforcement bars, and type of concrete mixes.

Assessment of the quality of the reconstructions

In relation to quality, Boen (2008) reveals interesting observations from his regular visits to Aceh reconstruction sites. He argues that the community based reconstruction approach poses difficulties in controlling the quality of the work. Poor quality material and poor workmanship are the main problems that he noted during his visits, which in turn led to poor quality housing. Furthermore, Boen (2008) also criticised the introduction of new building technology and materials in the Aceh reconstruction; what he referred to as alien construction methodologies. He concludes that the target for the Aceh reconstruction was the number of houses built not the provision of quality, seismic safe housing. This implies that the Aceh reconstructions failed to grasp the opportunity to reduce the vulnerability of housing for future earthquakes since most of the house constructed are not earthquake resistant (Boen, 2008).

In contrast, UN-habitat (2009) has produced a lengthy review report on settlement and housing recovery in Aceh-Nias following the 2004 tsunami. Chapter 2 of the report reveals monitoring systems conducted by the Unsyiah University which produced 'scorecards on settlement recovery (SSR)'. The scorecards evaluate the following indicators during the reconstruction: construction quality, satisfaction, and accountability. The score for construction quality ranges from 1 to 4 and is measured against the official building code. A score of 4 indicates that the quality exceeds the standards in the official building code, a score of 3 denotes that the reconstruction is 'in compliance', while a score of 2 or less is considered to be substandard quality. Their survey in 2006 indicated that the average construction quality score is 2.65 which is 'broadly acceptable' (UN-Habitat, 2009, page 73). Interestingly, one of the survey findings, the quality-satisfaction matrix, UN-habitat argues that no clear relationship exists between construction quality and house beneficiaries' satisfaction (UN-Habitat, 2006). UN-Habitat (2009) acknowledge the demanding nature of the building standard whilst recognising that the Aceh construction workers' expertise was poor.

One year after the 2006 Yogyakarta earthquake, Afriadi et al., (2008) conducted a survey to evaluate the result of the reconstruction which was mostly implemented by the community. They surveyed 42,056 houses in Yogyakarta and Central Java province where the survey was based on direct observation and interviews with the home owner. The survey consisted of 40 questions in 11 sections which reflected the structural quality of the house. In the survey they concluded that the quality of the houses was relatively good, although only 6.4% (in Yogyakarta) and 6.8% (in Central Java) of the houses surveyed met all seismic requirements. However, more than 87% (in Yogyakarta) and 94% (in Central Java) of the houses exceeded 60% of the specified requirements. Smaller size of the RC bar and connections between structural components were the main concerns in the survey findings.

Discussion

From previous sections it becomes apparent that quality is an important issue in post-disaster reconstruction. Inadequate levels of quality in the reconstruction can be traced back to human related factors which include improper handling and storage of material, poor construction workmanship and inadequate supervision. For this reason, knowledge communication is needed in order to improve quality of the work, to spread the best practices among project participants, and to reduce costly mistakes and rework.

Construction workers in Indonesia may be divided into two groups. The first group consists of those who are in management roles on the project and who, mostly, have college or university backgrounds. The second group is composed of semi skilled/unskilled labour, often referred to locally as '*tukang*'. They do not have a trade but traditionally evolve from farmers who look for temporary work after the crops are harvested. Their educational background is poor with more than half of the workers having only an elementary educational background or less (Soemardi et al., 2011). This condition was exacerbated when following the disaster the workers were also victims and workers from other fields, with barely any construction experience, became involved in the reconstruction process.

There are various approaches to post-disaster reconstruction, from financial support only to donor-driven reconstruction (Jha et al., 2010). The implementation of the construction of houses in the reconstruction phase may be conducted by the disaster-affected community or by local contractors with technical support and supervision provided by 'facilitators' hired by the NGOs. In the case of Indonesia, both approaches will be conducted by local builders ('*tukang*').

It seems there is a knowledge gap in reconstruction quality and a disparity between construction implementation and the requirements for safe construction. This is a role that could be filled by outside agencies, such as NGOs, to fill the gap by transferring their knowledge and by educating local construction experts and workers (Ingirige et al., 2008). They can communicate their knowledge about earthquake-safe structure to disaster-affected communities, which may include basic knowledge about house's structure (beam, column, and joints), construction materials, and good construction methods.

However, there are some barriers to communicating knowledge to workers (Hidayat and Egbu, 2011), which may come from the sender-receiver approach (who possess the knowledge and who is looking for knowledge) (Eppler, 2007, Liyanage et al., 2009). For instance, using the model developed by Liyanage et al (2009), the workers, as receivers, must be willing to acquire knowledge and have adequate absorptive capacities.

There is some resistance from the '*tukang*' in accepting the new knowledge related to seismic safe construction, due to local customs and knowledge from the facilitators provided by the NGOs the majority of whom are graduates fresh from university and they are perceived as having little experience. They need good reasons to change their construction habits, as mentioned by one of respondents:

"If he ['tukang'] directly sees the evidence, he can simply change his habits. For example, previously, he builds a house with concrete and reinforced steel but after the earthquake the house is cracked or collapsed, then he will quickly change his habits. The habit here is to use 8mm bars for concrete reinforced steel, as long as

he has no experience of a collapsed house, it will take a long time for him to adjust his habits (R19-NGO)”.

Gharaati (2010) argues that it is not enough to teach builders what to do for building safely but more importantly why it is necessary to do so. The explicit knowledge that the builders can get from posters or pamphlets is not sufficient. According to Gharaati it is more important to teach tacit knowledge using hands on training but this approach requires significant time to be developed. She conclude concluded “*unless there is careful planning in advance, the transfer of knowledge through post-disaster programmes in developing countries will remain only a myth*”

Conclusion

In the post-disaster reconstruction, it is important to ensure the sufficient quality of the works, as the finished project will also contribute to the capability of disaster-affected community towards the next disasters. However, from previous reconstructions in Indonesia reveal that human factor (e.g. skills and knowledge of local builders) is the main contributor to substandard quality. Knowledge communication may play an important role in achieving desired reconstruction quality by conveying the knowledge to the recipients (the builders).

Reconstruction programmes are limited by time frames, so perhaps the best time to transfer knowledge to builders is in preparedness stage of disaster management. The focus should be on how to improve the level of workmanship of builders so that projects will implement disaster-safe regulations and be ready for future disasters; the responsibility for this activity lies in government hands. At project level, it suggest project managers should have close interaction, face-to-face communication on the project and interaction between those in management and the workers allowing knowledge to be steadily conveyed. Indonesian academia should start to focus more research on housing construction and construction’s human resources which have been overlooked in education in university level.

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A Critical Review of the Drivers to the Integration of Site Level Sustainability Practices into UK Construction Projects

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Abstract

There is a breadth of information available on the drivers to sustainable construction but this is not necessarily focused at the site level, hence research is needed in this area. Part of a literature search, undertaken as part of a PhD study, to investigate available information and research into the inception of sustainable construction practices is reported. Drivers to the adoption of sustainability in construction at site level is specifically reviewed across a range of sustainability literature of which eight publications were found to have relevance to sustainable construction and have been broadly categorised to aid future investigation of their applicability to projects. The categories being those which are external drivers (supply, demand and trading environment) and those which are internal drivers (resources, cultures, systems and human nature). The relevance and impact of these drivers is also discussed as well as their criticality. The pressures which drive a project to adopt sustainability, such as industry trends, require research to catalogue and measure them which this paper attempts to do.

Keywords

Literature review, construction, drivers, site practises, sustainability.

Introduction

Sustainable practices at the construction site level are examined from the perspectives of literature. The aim of this critical review is to summarise the main findings of the literature review and to analyse the information relative to the drivers to the integration of site level sustainability practices into UK construction projects.

The article is structured into 5 main sections. In this introduction, definitions of sustainable construction are considered. This is followed by a section on background literature on the drivers to the inception of sustainable construction. The impact and categorisation of drivers of sustainability are then considered before a discussion section and conclusion.

Kibert (1994) produced one of the seminal definitions of sustainable construction "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles". This is the new paradigm (Bordeau et al 1998) that the industry needs to address as one of the largest consumers of natural resources (Griffiths et al 2003). However the entire issue is encapsulated by Bidarianzadeh and Fortune (2002, p. 569) "the construction industry, undeniably, has a huge impact on the environment and the term 'sustainable construction' may seem to contain an oxymoron can an industry such as construction traditionally so

thoroughly dependent on the use of nature's resources and concerned primarily with creating new structures, answer increasing societal and, in turn governmental demands for a sustainable industry?". Perhaps this issue can be eased in some minds by noting that the definitions of sustainable construction do not preclude the use of natural resources but does look for a reduction in the rate in which our resources are used (Ofori et al., 2000).

It is interesting to note that Kibert (2007) follows up on earlier work and the changes that have occurred over the past decade and particularly notes that there are shortcomings in relation to legislation and perception. The industry has gotten to grips with the general terminology and the issues which are present; however, there has been a limited uptake of the issues into the mainstream. This is backed up by a claim that UK construction needs to move away from a voluntary system of sustainability assessment and towards legislation driven agenda. The basic principle of sustainability being built on the three pillars of environment, economics and social issues however there is an absence of balance (Dewick and Miozzo 2002) in the UK with slow progress towards the inclusion of social and environmental considerations compared to other European countries (however the author is not specific on which countries have been included in the comparison). Balance needs to be maintained in all aspects of the inception of sustainability.

Drivers still under active research including reviews of drivers to sustainable construction in Finland(Hakkinen and Belloni, 2011a)

This paper looks at the issues that have been highlighted as part of a literature review associated with a PhD study. This paper highlights some of the findings of a study ostensibly looking at the practices which are being or should be enacted on construction sites to bring about the overall aims of sustainable construction. The overall project will look at the current issues driving and working against the inception of sustainable working practices. Table illustrates the overall project scope and framework.

Drivers are the subject of a certain amount of focus especially in relation to the requirements for the development of sustainability indicators. However, compared to the work that has been published in relation to the barriers to sustainable construction and allied areas the coverage seems to be sparse.

It is important to understand the drivers to the adoption of sustainable construction as this deals with the fundamental question of what it is that is moving or will be moving the industry to a more sustainable form of construction.

The Egan Report (1998 p.4) identified, "five key drivers of change which need to set the agenda for the construction industry at large: committed leadership, a focus on the customer, integrated processes and teams, a quality driven agenda and commitment to people ." Whilst these are not all applicable to the issue at hand it is suggested that a number of these issues will be important to the construction industry in its movement towards a more sustainable future.

Table 1 - Project Scope and Framework

Literature review	Area of interest	Potential areas applicable
Site working methods	Economic	Lean construction, value engineering
	Social	Health and safety, apprenticeship schemes
	Environmental	Pollution management, Dust management
Perception of barriers at site level	Internal	Lack of knowledge, cost distribution
	External	Regulatory restrictions
Perception of drivers at site level	Internal	Cost saving/operational efficiency, competitive edge, company survival, reduction of legal risks
	External	Government regulation, client procurement policy, peer pressure

Background

The government and other bodies have developed a significant number of initiatives such as the Government 'Building a better quality of life' (DETR, 2000) which aims to guide and drive forwards sustainability in construction. These are principally aimed at high level issues and the development of a sustainable construction project (Edwards and Hyett, 2001) rather than the inception of sustainability in the production of the structure. A significant number of the incentives are in relation to larger concepts such as action plans (Addis and Talbot, 2001) and initiatives and to a lesser extent they deal with the site level inception of sustainable construction practises.

Manoliadis, Tsolas and Nakou (2006, p. 115), through the use of a Delphi analysis, concluded that, "important factors of change in Greece are energy and resource conservation as well as land use regulation and urban planning policies." Manoliadis, Tsolas and Nakou (2006) expanded on these findings and outlined fifteen drivers for change to implement sustainable construction these being: energy conservation; waste reduction; indoor environmental quality; environmentally-friendly energy technologies; resource conservation; incentive programmes; performance-based on standards; land use regulations and urban planning policies; education and training; re-engineering the design process; sustainable construction materials; new cost metrics based on economic and ecological value systems; new kinds of partnerships and project stakeholders; product innovation and/or certification and recognition of commercial buildings as productivity assets. Al-Yami and Price (2006) note that drivers should be those that stimulate stakeholders to adopt sustainable design in their building project at the briefing process. This study will review those drivers relative to on-site and design aspects of sustainability in construction, to provide information on routes to implement sustainable practices within the operational and design stages of construction.

Potentially the closest work to that in hand was undertaken by Adetunji et al (2003) as such the main findings of this research have been provided below Based on a sample of contractors with a turnover of 100 - 500 million pounds, ranked the drivers for sustainability as;

- Government and regulation
- Competitive edge/market growth
- Client procurement policy
- Enhance reputation/brand
- Business pressure
- Long term survival of business
- Enhance relations with clients
- Cost saving/operational efficiency
- Environmental concerns
- Reduce legal risks and penalties
- Enhance shareholders value
- Investing in the future
- Following industry trends
- Enhance relations with community
- Enhance relations with employees
- Licence to operate
- Peer pressure within the industry
- Enhance relations with suppliers

Whilst this provides a basis for review the survey was completed by 26 respondents split into three turnover categories from below £100m to above £500m. This represents a relatively small sample. In addition the survey was predominately completed by sustainability, health and safety and environmental specialists, personnel who it could be argued are divorced from the formative management decisions on construction projects. It is proposed that the overall study of which this paper represents a subsection will encompass a larger sample population and will be targeted at the onsite decision makers including the supply chain partners.

Slaughter (2000) categorised innovation in construction in the form of five models, these being incremental, modular, architectural, system and radical. Six drivers of change were also highlighted these being;

- Globalisation and competitive strategies.
- Organisational culture and cultural changes.
- Usage of IT.
- Performance measures and benchmarking for continuous improvement.
- Best practises for Constructability Implementation.
- Sustainable development.

This is if course only applicable and of interest to this study where the innovative products and processes reflect sustainability.

The information that has been reviewed shows a range of drivers however it should be noted that there are number of limitations to the information as listed below.

Categorisation of Drivers

The research into the barriers to sustainable construction has noted a number of ways in which the barriers can and have been categorised. However, the literature review into the drivers of sustainable construction has not found a similar drive to produce systems of categorisation.

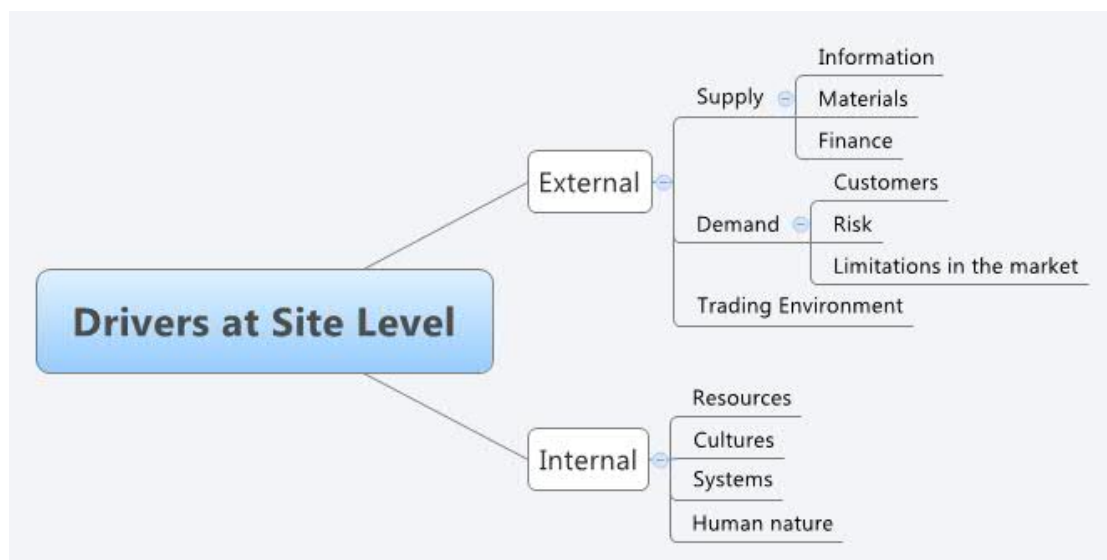
To this end work on the classification of barriers has been used. Barriers can be classified in a number of ways, one that may be appropriate to this study is one that looks at those external to the firm or exogenous and internal or endogenous ones (Roy, 1985).

Roy (1985) indicates that external barriers, "can be classified into supply, demand and environmental related. Supply barriers would include problems information, raw materials, and finance. Demand barriers have to do with customer requirements, their perception of the risk of innovation, and limitations in the market place. Environmental ones include various government regulations, antitrust measures, and policy actions."

Internal barriers can be further subdivided into resource related; culture and systems related, and human nature related. Murillo-Luna et al., (N.d.) also use the same when looking at "Barriers to the adoption of proactive environmental strategies."

The primary sources of material were Adetunji et al., 2008, Manoliadis et al., 2006, Hakkinen and Belloni, 2011b, Yip Robin and Poon, 2009, and Warhurst, 2002.

An attempt has been made to categorise the drivers in such a way that their indicative areas of influence can be viewed. However, this has to a degree had to be inferred from literature that has been reviewed as this is a factor that was not specifically covered by papers reviewed. This is a potential gap in the research and thus the available information especially in relation to the specificity of these drivers at the site level. This is therefore an item that may need to be explored as part of the research into the perceptions of people at the site level.



Many of the papers review the issues from the perspective of senior personnel involved and this has potentially not captured the perception of the site level. The papers have therefore not reviewed the full range of the effects and assumed that the barriers are those which are set at the strategic level of the project.

In total eight reference sources presenting unique research as opposed to critique of other authors work were assembled. All of the references were assembled manually and included within a spreadsheet to capture the context of the paper reviewed, the findings and the assigned categories. The items were then manually coded with

each of the categories indicated in Figure 1 being signified by a simple number to allow the data to be sorted and grouped following the coding exercise.

This is exemplified by major drivers being encoded as below

- Client procurement policy or Indoor Environmental Quality – Coded as External, Demand, Customers.
- Government regulation – Coded as External, Demand, Risk
- Competitive edge – Coded as Internal Resources

Discussion of Literature Review Findings

Figure 1 shows the initial categorisation that has been used in the detailed review of literature dealing with drivers to sustainable construction. These have been assembled based on a detailed review of electronic sources located by use of a number of search engines e.g ScienceDirect, ProQuest, ingentaconnect and Web of Knowledge. These were subsequently reviewed to provide information on the issue at hand and also to prepare details of additional sources of information that would increase the depth of knowledge on the subject.

From the exercise of categorising the information the areas which have been found to have the highest number of entries and therefore perceived to be the greatest drivers to sustainability. The three most significant are in descending order;

1. The client and their requirements is a significant driver of sustainable construction and as noted earlier a significant barrier when a client does not have a specific requirement for a project to meet and specific sustainability goals.
2. The role of the government is also seen as a key driver both in the role as the biggest single client to the construction industry and also in its role in setting national planning requirements and other legislation which directly influences or guides the construction marketplace.
3. The majority of the drivers to sustainability are external to a company with very few internal drivers having been noted.

It has been noted that there are some clear gaps in the information or in the coverage of the areas of sustainable construction. It has also been noted in earlier sections that sustainability is based on the three pillars of social, economic and environmental factors. There are a number of areas that are not well covered or at least are perceived as unimportant to sustainable construction. Whilst Clients and government intervention are shown to be significant in relation to decisions about sustainable construction and thus the economic pillar there is seems to be a lesser amount of importance which has been given to the of environmental and social pillars.

There may be a number of causes of such a finding which could be due to bias be it from:

- A realistic representation of the way in which sustainability is actually perceived and that construction is still biased towards the economic pillar.
- The other two pillars are seen to be of a lower order issue or that these are seen to be the role of government which has instigated a number of Acts and Regulations in relation to the environmental and social issues.

The literature review has not found significant information on the categorisation of drivers as such as the categorisation of barriers detailed above has been used to assemble the data and to allow an initial review of the issues that have been drawn out as part of the literature review.

Government as a driver

The Government has been found to be the most significant driver of sustainability in construction. A review of available literature notes that the government has attacked the issue in a number of ways.

The Welsh Assembly government (The makeup of legislation in Great Britain is differentiated on a national level due to the self governing nature of Scotland, Wales and Northern Ireland) has set definitive targets (Welsh Assembly Government, 2010) using national planning policy to set targets relative to the BREEAM and Code for Sustainable Homes (CSH) standards. In the same manner local authorities have set standards relative to sustainable development gains typically setting standards using the BREEAM (B. R. E. Global, 2011) and CSH systems and in many cases setting additional requirements in relation to the reduction of energy emissions below those which have already been set by Building Regulations. Many local authorities have also established targets through the use of the planning process relative to the achievement of various levels of the Code for Sustainable Homes and BREEAM. Along with these often specific targets for the reduction of CO₂ emissions are set.

At the national level changes to the building regulations and proposed future changes have brought about required improvements to reduce the energy demands of new buildings. In addition the government has introduced waste legislation (The Waste Management (England and Wales) Regulations 2006) to encourage the reduction in the levels of waste that is generated and via taxation has incentivised the reduction of waste to landfill.

This is in itself part of a government requirements (Minister for Housing and Planning 2006) that some of the energy on all new developments should be via on site renewable energy Clean Neighbourhoods and Environment Act 2005 (Used to enact the requirement for construction projects to have a Site Waste Management Plan available on construction projects with a value in excess of £300,000.)

Landfill Tax and the aggregates levy has been instigated (As part of the government action plan to reduce the reliance on the production of waste for landfill and also on the removal of first grade aggregates)

The Sustainable and Secure Buildings Act (2004) (The act changed the purpose and scope of application of the Building Act 1984 such that sustainable development and environmental issues could be addressed. The key areas of change included the “(b) furthering the conservation of fuel and power, (c) preventing waste, undue consumption, misuse or contamination of water, (d) furthering the protection or enhancement of the environment, (e) facilitating sustainable development, or (f) furthering the prevention or detection of crime,”). It should be noted that these important drivers are ones which not only influence the overall design but in relation to the study at hand directly impinge on way in which construction sites act and the practices which are adopted in relation to the management of waste on site.

Clients as drivers

Clients are seen as a major driver to sustainability with the government having been noted as one of the largest procurers of construction projects accounting for in the order of 25% of all construction. The government requires that all new construction that is procured to achieve a relevant BREEAM rating. In the same way the government has attached a similar stipulation to schemes which received government financial support.

In addition a number of major clients or tenants request that the building meets some form of sustainability criteria the most common of these being a requirement to meet some level of BREEAM certification. The BREEAM system (B. R. E. Global, 2011) The BREEAM scheme sets a number of goals to be achieved which directly influence and have led to the introduction of modified sustainability practices in such areas as;

- Monitoring energy consumption on the site.
- Monitoring of water consumption on the project.
- Monitoring of transport to and from site including the quantities of waste from the site.
- Use of sustainable timber

Future research issues

It is anticipated that it will be necessary to review the system of categorisation of the drivers to allow for a more representative breakdown of the information for analysis. The information collated thorough the literature review has proven to be difficult to catalogue due to a number of factors which have included;

- The different viewpoints which each of the studies represents meaning that the studies that have been used to assemble the information do not have the same basis or datasets.
- The majority of the studies and papers that have been assembled present tabulated results which lack in context which allows for a fuller understanding of the meaning of the elements and detail that is necessary to allow a definitive cataloguing of the information.
- The classification of the information has been undertaken by the researcher and thus may be subject to individual bias and the researcher's viewpoint and point of reference.

The drivers have been broken down into those which are external to and those which are within a company or project.

The investigation shows that there is a need for a classification system which is clear and understandable that can be used to formulate and shape the questions which will be investigated. This will be reviewed further with a view to increasing the clarity of the investigation that are undertaken and also allow for a more justifiable grouping of information that is collected.

Conclusions

The foregoing shows that there appears to be a small range of key drivers. It also highlights a number of areas that will need to be looked at in some depth as part of the ongoing research part of this project, these include;

- The development of a more appropriate system of classification, in order to develop one which may be more representative
- Development of a deeper understanding of the primary issues that need to be investigated as part of the research section of the project.
- The information will provide a strong basis for the targeted investigation of the drivers that are present at the site or project level.
- The review has found what appears to be only a small range of drivers and as such it is questionable as to whether the overall goals of sustainability in construction will be met and if driver these are sufficient.

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Sustainability of Built Environment of Higher Education Institutions in (HEIs) in Nigeria: Factors Militating Against It

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Abstract

Sustaining Higher Education Institutions (HEIs) built environment in Nigeria to an appropriate and acceptable standard requires adequate provision of the following necessities that give comfort to the users. Such necessities include-(1)-regular supply of electricity; (2)-adequate and regular supply of water; (3)-established waste water treatment and maintenance system; (4)-well managed drainage system; (5)-procurement strategies; (6)-maintenance methods (7)-and adequate budgetary allocation. The outcome of an initial exploratory study of the issues mentioned above in relation to HEIs built environment in Nigeria are presented in this paper. The research adopted and used a qualitative research strategy that made use of a series of semi-structured interviews with Directors of works and services of the 12 HEIs used as samples in Nigeria. Following the systematic analysis of data collected, it was revealed that, a general paucity of funds allows for poor sustenance of built environment across both the federal and state types of HEIs in Nigeria. The study reveals that, lack of use of the following sustainable toolkit have an impact on the effective and efficient sustenance of the built environment of HEIs in Nigeria. Such toolkit include-maintenance schedules, maintenance programme, facility register, history record, maintenance planning, maintenance profile and establishment of a quality control unit within works and services departments of HEIs in Nigeria. In summary, suggestions are made to assist key decision makers to develop enduring solutions to such sustainability challenges of HEIs built environment, that will improvise for such necessities that will bring comfort to the users of HEIs built environment in Nigeria.

Keywords

Sustainability, Environment, Assets, Controltoolkit and Comfort.

1.0 Introduction

Sustainability is said to be a debatable issue across the world, and has three integrated essential fundamentals which makes it a holistic concept (Spilans et al., 2009). In addition, those three essentials are: (i)-environmental factor, (i)-economic factor, (iii)-and social factor. Ugwu and Houpt (2007) assert that, these factors form the framework upon which to assess building maintenance management. “Our common future-the development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. These can generally be referred to as addressing the fundamentals of the sustainable development concept (George,1999).



Figure I: Examples of a Higher Education Institution Buildings in dilapidated conditions.

Alameda (2002) divided the principles of sustainable development into three, such as-(i)-build for the long term-construct buildings that are durable and long lasting, (ii)-build for our children-make their environment safe, and build for the planet-use materials from sustainable resources. However, the discussion above centre on how to sustain Higher Education Institutions built environments for academic, economic, and as well as working in a friendly way with the environment.

An enduring solution to HEIs challenges could be found in the form of regular and adequate provision of essential services that give comfort to the users. Those services include (1)-provision of regular supply of electricity; (2)-adequate supply of drinkable water and treatment for re-cycling; (3)-waste collection, disposal and treatment for re-cycling;(4)- drainage system and treatment for re-cycling; (5)-procurement strategies (use of outsourcing or in-house staff or combination); (6)-maintenance methods (planned preventive, curative or conditions surveys), (7)-and maintenance budget.

1.1 Justification of the Study

A cursory look at some HEIs buildings in Nigeria suggests that there are no programme to sustain them. It is suspected that some HEIs have not considered budgeting for sustaining their built environments. In Nigeria, ownership of HEIs can be categorised as being federal government owned, state owned, and those owned by private individuals. For the purpose of this study, emphasis shall be placed on south western Nigeria (comprising of six states), and those HEIs owned by various governments. In this geo-political zone, there are fifteen HEIs, which evidently shows the commitment of the Nigerian government towards ensuring better quality of life for its citizens.

However, meaningful skills and knowledge need to be imparted to learners in a very conducive environment. In addition, the workplace for academic and other faculty staff must also be conducive. The study needs to evaluate current approaches to asset sustainability in HEIs and develop a new framework for HEIs works and services departments that reflects sustainable built environments.

1.2 Aim of the Study

The study needs to assess the constraints of HEIs works and services departments in Nigeria with a view to evaluating their procurement strategies, maintenance methods, maintenance budget, and cultural influence in sustaining HEIs built environments. The study aims to propose a theoretical strategic framework on asset sustainability of HEIs in Nigeria.

1.3 Objectives of the Study

- To establish current theoretical approaches to maintenance of assets in the context of “Assets Sustainability”.
- To assess and evaluate works and services departments constraints in relation to procurement strategies, maintenance methods, maintenance budget, and cultural influence in the asset sustainability of HEIs buildings in south west, Nigeria.
- To develop a theoretical assets sustainability strategic framework for HEIs in Nigeria.

2.0 Research Methodology

Methodology is the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of methods to the desired outcomes. Dainty (2008) asserts that, there are four philosophical paradigms such as Ontology, Epistemology, Oxiology and Rhetorology. The author explains further that, the selection of any philosophical paradigm should consist of three essentials, such as Ontology, Epistemology and methodology. Crotty (2005) asserts that all the three essentials mentioned above need to be related to one another rather than merely set side by side as comparable, perhaps as competing approaches or perspectives.

2.1 Mixed Method

For the purpose of this study, both the qualitative and quantitative approaches (mixed method) shall be used. However, for the purpose of this presentation, the

researchers used semi-structured interviews (qualitative) to collect the data been presented now.

2.2 Methodology and Data Collection Strategy

In the study, both hard and soft paradigms shall be used. For the purpose of this presentation, data were collected by conducting semi-structured interviews (qualitative) for the Directors of works and services of selected twelve Higher Education Institutions (HEIs) in Nigeria. The researcher intends to use triangulation method. Robson (2002) asserts that, triangulation when used enhances results credibility.

2.3 Research Design

Bryman and Bell(2003,p.32) define “research design as the ways in which the data will be collected and analysed in order to answer the research questions posed and to provide a framework for understanding the research”. The study sampled twelve HEIs out of the entire fifteen (federal and state owned) with one respondent in each HEI (Director of works and Services).

2.4 Sources of Data

For the purpose of this presentation, the researchers used both primary and secondary sources of data collection

2.5 Limitation of Methodology

The study shall be limited to the selected HEIs built environments in six states of the south western part of Nigeria. For the purpose of this presentation, the researchers used semi-structured interviews qualitative) for the Directors of works and services in the selected HEIs in Nigeria.

3.0 Research Questions

- Which of the procurement strategies do you adopt and use for-i-maintaining building structures-ii-domestic equipment-iii-and other services provided?
- Which of the maintenance methods do you prefer to use-and why?
- How do you estimate your annual budget-and what percentage is it of the Institution overall budget?
- How often do you carry out surveys on users satisfaction of the built environment that your department manages?
- How often do you ensure the delivery of quality in your projects-and how do you improve on it?
- What are your department programmes in sustaining the assets that you manage?

4.0 Summary of Findings

- The outcome of the recent semi-structured interviews (qualitative) conducted for the Directors of works and services departments of the selected twelve HEIs in Nigeria revealed as follow: All the twelve departments of HEIs in south west, Nigeria adopt and use outsourcing for large and complex maintenance projects, and in-house technical staff for the

supervision, monitoring and controlling of such projects. In addition, they all use in-house technical staff for small and simple maintenance projects.

- Majority of HEIs works and services departments don't use planned preventive maintenance method, instead, they prefer the use of conditions survey and curative maintenance methods-due to paucity of maintenance funds and delays in releasing same where available.
- Many of the HEIs works and services departments base the estimation of their annual maintenance budgets on consideration for the previous year budget and the prevailing market prices of materials, components and labour plus a percentage or lump sum increase, while some of them use budget forecasting.
- Almost all of the HEIs works and services departments in Nigeria don't carry out surveys on users satisfaction. They rely on letters of complaints from the assets users.
- In general, design of new maintenance projects are carried out by commissioned Consultants. Such projects are executed via outsourcing, while the in-house technical staff carry out the supervision, monitoring and controlling of the projects materials, components and workmanship.

Other findings include:

- Poor environmental protection, lack of resource conservation, and erratic supply of electricity.
- Poor supply of drinkable water.
- Waste of water (from rain, foul water and waste water).
- Poor waste collection, treatment and re-cycling.
- Poor drainage system.
- Lack of respect for people's health and safety, welfare and absence of social equity.

5.0 Suggestions and Recommendations

In the recently conducted interviews for the Directors of Works and Services departments of twelve HEIs in the South west, Nigeria, Adediran and Oyediran(2012) assert that, the use of routine and preventive maintenance methods cannot be adequately sustained due to inadequate funding. (Wahab; Oyeboji; Olaniyan; Layode; Ogunbadejo; Williams; and Oyekunle, 2012) assert that, their HEIs works and services departments in Nigeria have 5 years sustainability programmes which include in-service training for technical staff, and maintenance of defective parts of existing facilities and equipment.

Banjo(2012) asserts that, the current decentralisation of works and services department under her management is geared towards achieving quick response to maintenance issues. The Interviewee lists the benefits of environmental sustainability as, namely-(1)-lower crime rates (provides employment opportunities),-(2)-Improved health care (a better economic base),-(3)-and renewable supplies of energy.

- The HEIs works and services departments should on yearly basis prepare and attach their maintenance schedules and work programme with their departments annual budgets for their HEIs management approval and release of funds to time. The departments should also create a quality control unit

within-comprising of seasoned professionals from the consulting firms and the in-house technical staff(Olowoake, 2006;Olanrewaju et al.,2011).

- The HEIs works and services departments should endeavour to carry out reconnaissance surveys of their built environments with a view to identifying likely problematic areas, do the costing, prepare and attach annual maintenance schedules and works programmes for the approval and release of maintenance cash by their HEIs managements(Olowoake, 2006; RICS,2009).
- The HEIs works and services departments should twice in a semester(at the beginning and the end carry out surveys on users satisfaction of the built environments they manage(David,1998;Justine and Keith,2008; Olowoake,2006; RICS,2009).
- The HEIs works and services departments should create a project control unit within, and the duties of the unit is to supervise, monitor and control maintenance projects materials, components and workmanship in order to ensure cost saving, quality deliveries of projects within time limit (Olowoake,2006).
- For the departments to sustain built environments effectively, they should endeavour to prepare and use environmental sustainability toolkit, such as maintenance schedules, work programme, facility register, history record and maintenance planning (Brian and Brook, 2009; Chika,2008; RICS,2009; Olowoake,2006; Iwarere and Lawal,2011).

Others include the following:

- Decrease energy consumption-by using materials with low energy input requirements to achieve Zero carbon (Co2) building concept(Brian and Brook,2009).
- Implement new standards in design, construction, heating, power, waste disposal and regeneration of existing poor living communities(Brian and Brook,2009).
- Make use of materials from sustainable resources and minimise sustainability costs by designing without compromising the satisfaction of the end users(Brian and Brook,2009).
- Implement zero carbon schemes designed for large settlements economically, socially and technically, and*Construct durable buildings by making the environment safe(Ding,2005).
- Protect and conserve the environment and create interest in people's welfare, good health and safety (Nutt,et al.,2000).
- Re-cycle waste water, foul water and rain water.
- Re-cycle wastes generally, regenerate our Urban areas (revitalise decaying areas) by providing decent, affordable housing, community services and shopping(Cooper and Jones,2008).

6.0 List of Participants (Directors of Twelve Selected HEIs in Nigeria)

I-Adediran,M.M.(2012) Moshood Abiola Polytechnic, Abeokuta, Nigeria.

II -Adenuga,O.(2012) Tai Solarin University of Education,Ijebu-Ode, Nigeria.

III-Ayeye, O.(2012) University of Lagos, Nigeria.

IV-Banjo,O.T.(2012) Federal University of Agriculture, Abeokuta, Nigeria.

- V-Layode,K.(2012) Yaba College of Technology, Lagos, Nigeria.
- VI- Olaniyan, S.(2012) University of Ibadan,Nigeria.
- VII-Ogunbadejo,O.A.(2012) Federal Polytechnic, Ilaro, Nigeria.
- VIII-Oyebanji, M.(2012) The Polytechnic, Ibadan, Nigeria.
- IX-Oyediran,A.T.(2012) Obafemi Awolowo University, Ile-Ife, Nigeria.
- X-Oyekunle,F.A.(2012) Olabisi Onabanjo University, Ago-Iwoye,Nigeria.
- XI-Wahab,S.(2012) Lagos State Polytechnic, Ikorodu, Nigeria.
- XII-Williams,S.T.(2012) Olabisi Onabanjo University, Ago-Iwoye, Nigeria.

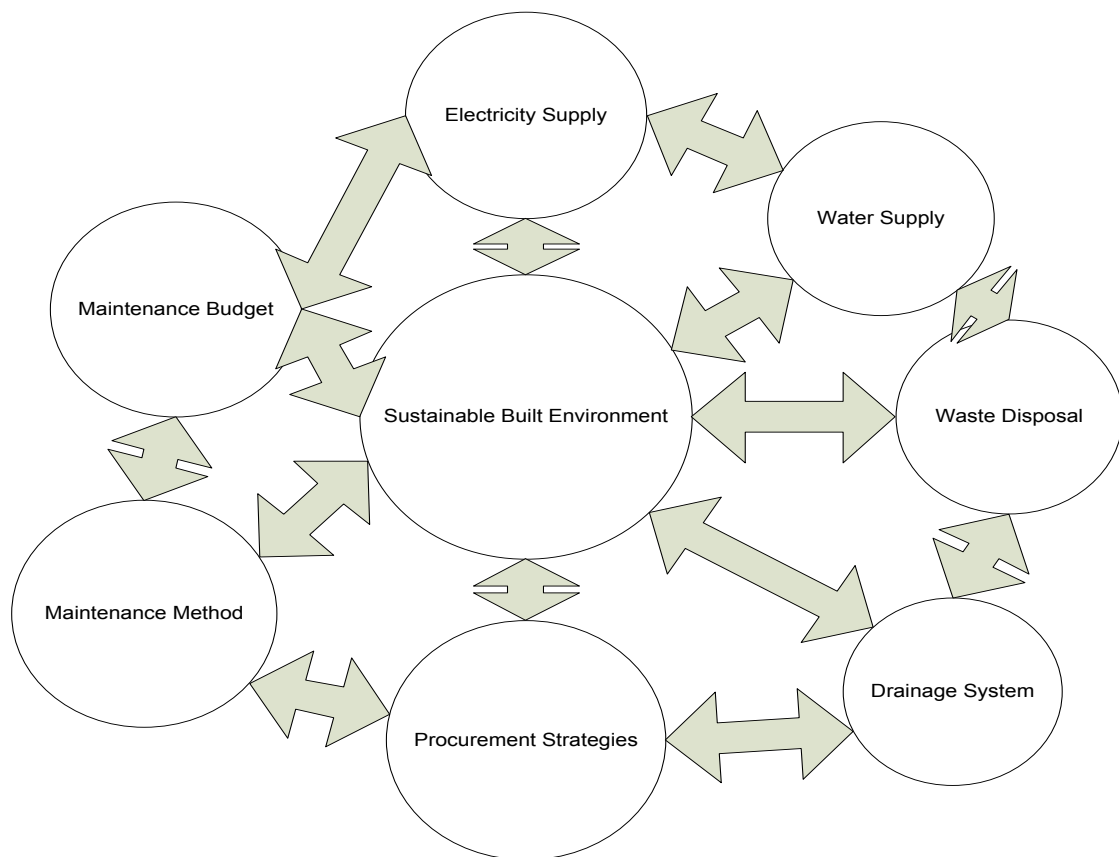


Figure II: Shows the Proposed Framework for Sustainability of HEIs Built Environments in Nigeria.

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Gender Mainstreaming and Sustainable Post Disaster Reconstruction

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Abstract

Gender inequalities are barriers to achieve sustainable post disaster reconstruction. Mainstreaming gender equality within post disaster reconstruction process can enhance sustainability of reconstruction. Based on a detailed literature review on post disaster reconstruction, this paper identifies pre-requisite conditions for mainstreaming gender within sustainable post disaster reconstruction as ; awareness of gender needs and concerns, a strong gender policy framework, women participation and leadership as an agent of change, gendered institutional capability, flexible and decentralised structure of gendered policy planning.

Keywords:

Gender mainstreaming, sustainability, post disaster reconstruction

Introduction

Gender mainstreaming is widely believed as one means for enhancing sustainability of reconstruction and development (Khatun, 2003; Yonder et al., 2005; Chakrabarti, 2009). Yet the integration of gender mainstreaming within sustainable post disaster reconstruction is uncommon (Walker, 1994; Morrow and Enarson, 1996; Fothergill, 1996; Fordham and Ketteridge, 1998). The common practice has been to use men's experiences as a universal category. Women's experiences and needs have been invisible (Fordham, 1998). Within this context, this study elaborates the links between gender mainstreaming and sustainable post disaster reconstruction. Pre-requisite conditions for making gender mainstreaming works within sustainable post disaster reconstruction and development are identified from gender and post disaster reconstruction policies in five affected disaster countries. Study was based on a detailed literature analysis and synthesis.

Gender, disaster and reconstruction

Disaster is not only naturally constructed but also socially constructed (Pelling, 2001; McLaughlin and Dietz, 2007; Enarson, 2012). The social construction of disasters results from power inequalities in society that leads to vulnerability of certain groups (McLaughlin & Dietz, 2007). Enarson (2012) explains that gender relations, as power relations between women and men, often place women in a subordinated position in disaster contexts. Hence, women are made more vulnerable to disasters through their socially constructed roles. As Enarson (2012) states "...gender shapes the social worlds within which natural events occur." The sexual division of labour, unequal access to resources and women's lesser participation in decision-making has significant repercussions on women's vulnerability within

disaster contexts. Supplementing such vulnerabilities, studies have also documented gender inequalities and its impacts within post disaster reconstruction (UNISDR, 2010; Enarson, 2012). Table 1 presents types of gender inequality and its impact on reconstructions.

Table 1: Type of gender inequalities within post disaster reconstruction

Gender inequality	Example	Impact
Shortage of women voices within planning process	Women concerns and preferences are often neglected during consultative process to design housing, water and sanitation, land titling, and local economic development activities.	Women less access and control on properties and economic resources.
Shortage of women leadership during reconstruction	Lack of women leadership within reconstruction causes women needs and concerns do not fully addressed.	Unsustainability of reconstruction may result in due to women needs and concerns are not fully accommodated.
Man bias in properties right	Women have no right on land and houses which may put them on the verge of losing livelihoods and assets after disaster.	Women lost their assets which mean they more vulnerable to be poor following reconstruction.
Man bias on access labour and credit policies	Lack of access of women on labour market and credit increases poverty following disaster.	Women poverty which indicates unsustainable development following reconstruction.
Bias of women health needs on accessing health services	Women have distinct health needs such as reproductive health and increased risk of violence. Protection risks to women are often neglected when health risks increase due to disaster.	Women poor health which indicates unsustainable reconstruction and development.
Lack of safe environment for women and girls after disaster	Public housing and sanitation fail to secure a 'female-friendly' environment with separate space for women to care for their children or sanitary facilities. As a result, women become subject to threat of harassment and sexual violence.	Lack of housing and safe space put women at high risk of violence. Unsafely community also indicate unsustainable reconstruction and development.

Source: UNISDR (2010); Enarson (2012)

Gender equality and sustainable post disaster reconstruction

Sustainability of post disaster reconstruction is vital for ensuring that the development opportunities within reconstruction can benefit present and future

community development (Mileti, 1999). Without considering sustainability, post disaster reconstruction efforts will not contribute to long term development and may result in unsustainable development outcomes. Accordingly, Broadbent and Broadbent (2007) define sustainable post disaster reconstruction as an approach to redevelop an affected region that considers not only the present needs of communities but also contributes to future needs of community development of affected regions. Sustainable reconstruction implies that reconstruction efforts should aim to re-build, enhance, and then maintain the quality of life of members of the disaster-stricken community in the short and long term (Mileti, 1999). Post disaster reconstruction thus could be a move for achieving a sustainable development agenda as it opens various social, economic and environmental development opportunities for rebuilding better communities.

Gender inequality is often considered a root cause of vulnerability and unsustainable development (UNISDR, 2004; World Bank, 2012). Women often lack of access to social and economic sources due to their subordinated status in society. This lack of access causes women in vulnerable and poor condition. While poverty means not having enough to eat, a high rate of infant mortality, a low life expectancy, low educational opportunities, poor drinking water, inadequate health care, unfit housing and a lack of active participation in decision-making processes. The effects of all these are the consequences that poverty and gender inequality impose on the environment which must not be sustained. The *Beijing Platform for Action* notes the linkages among poverty, natural disasters, unsustainable development and gender inequalities (World Bank, 2012). This *platform* sets out three strategic objectives: (1) involve women actively in environmental decision-making at all levels, (2) integrate gender concerns and perspectives in policies and programmes for sustainable development, and (3) strengthen or establish mechanisms at the national, regional or international levels to assess the impact of development and environmental policies on women. These strategic objectives examine the issue of women and the environment and emphasize the essential of gender equality to reduce poverty and to achieve sustainable development.

World Bank (2012) defines gender equality as the extent to which men's and women's opportunities and outcomes are constrained or enhanced solely on the basis of their gender. Gender equality concerns women and men, and it involves working with men and boys, women and girls to bring about changes in attitudes, behaviors, roles and responsibilities in the community. Genuine equality means more than parity in numbers or laws on the books; it means expanding freedoms and improving overall quality of life so that equality is achieved without sacrificing gains for females and males (USAID, 2012). Gender equality can be conceptualised in two ways: in terms of equality of opportunities and equality of outcomes. Equality of opportunities measures inequalities that arise from circumstances beyond the control of individuals. Equality of outcomes measures equality of results (World Bank, 2012). Both concepts can be useful, depending on the domain. In some domains, such as in health and education, where gender equality in outcomes may be inherently valued, it is reasonable to focus on equality of outcomes. In contrast, equality of opportunities may be the more relevant conception of gender equality in the economic sphere, where people's preferences may lead to different outcomes, even if their opportunities are equal.

The relevance of gender equality for sustainable development has long been established in intergovernmental commitments, such as the Rio Declaration on Environment and Development and Agenda 21 and the Beijing Declaration and Platform for Action (World Bank, 2012). These intergovernmental commitments state that gender equality is a core development objectives and key to effective and sustainable development outcomes. No society can develop sustainably without increasing and transforming the distribution of opportunities, resources, and choices for males and females so that they have equal power to shape their own lives and contribute to their communities. A growing body of research demonstrates that societies with greater gender equality experience faster economic growth, and benefit from greater agricultural productivity and improved food security. Participation, decision-making and management roles of women are critical to sustainable development processes, where they can be effective agents of change. Women, owing to lifestyle and consumption patterns, seem to be more concerned about the environment and have a greater sense of responsibility towards achieving sustainable development. Women also tend to hold themselves more accountable as consumers, are more likely to recycle, and use public transportation more often than men (Enarson, 2012). However, women’s lack of or limited access to resources, such as land, clean water and affordable energy, hinders their full participation in a green economy, and puts them at greater risk in times of natural disasters.

Figure 1: Gender equality and three dimensions of sustainable post disaster reconstruction

Source: adapted from Jones (2006); Lizarralde et al. (2009); Enarson (2012)

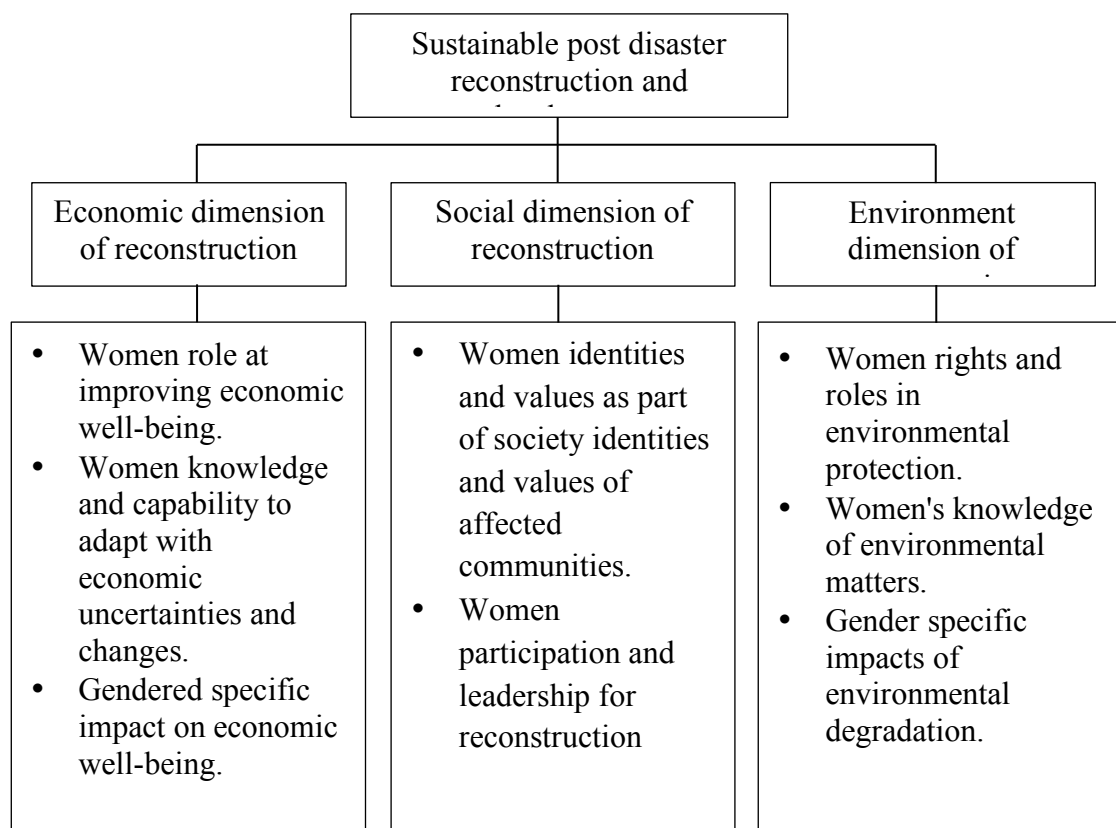


Figure 1 shows the links between gender equality and three dimensions of sustainable post disaster reconstruction and development. None of the three

dimensions of sustainable development can be achieved without long term investments in economic, social and environmental capital. Reconstruction of housing, water and sanitation should not only create healthy environments of affected communities but also should protect land and its ecosystem from disasters in the future. Environmental protection requires a solid understanding of women's relationship to environmental resources, as well as their rights and roles in resource planning and management. Acknowledgement and incorporation of women's knowledge of environment as well as an understanding of the gender specific impacts of environmental degradation matter for enhancing sustainable environment. However, the economic dimension means that reconstruction should be achieved by adaptation of economic systems to various uncertainties and changes in the environmental conditions (Jones, 2006; Lizarralde et al. 2009). Economic well-being requires gender-sensitive strategies. Women role at improving well-being is vital given the increasing of women poverty following disaster. Gendered specific impact on economic well-being will enhance economic sustainability. Finally, social dimension emphasises that reconstruction activities should recognise the extent to which social values and identities, relationships and social institutions of affected regions can be maintained and adapt to future disasters (Jones, 2006; Lizarralde et al. 2009). Integrating women identities and values is fundamental for maintaining society identities and values of affected communities. The participation and leadership of women is needed to identify needs and concerns of local communities during the reconstruction process. All of these need gender mainstreaming.

Gender mainstreaming and sustainability of post disaster reconstruction

Gender equality can be achieved through gender mainstreaming. CEDAW (1995) defines gender mainstreaming as a strategy for making women's as well as men's concerns and experiences as an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes. Gender mainstreaming is not an end in itself but a strategy, an approach, a means to achieve the goal of gender equality. It involves ensuring that gender perspectives and attention to the goal of gender equality are central to all activities - policy development, research, advocacy or dialogue, legislation, resource allocation, and planning, implementation and monitoring of programmes and projects. Gender mainstreaming is not about adding a "woman's component" or even a "gender equality component" into an existing activity. It goes beyond increasing women's participation; it means bringing the experience, knowledge, and interests of women and men to bear on the development agenda.

The term "mainstreaming" came from the objective to bring attention to gender equality into the mainstream or core of development activities. A number of important elements in the mainstreaming strategy can be identified. These include the necessity to ensure: attention to gender equality from the initial stages of processes so that there is potential to influence goals, strategies and resource allocations and bring about changes in policies, programmes and other activities; gender analysis of the roles, responsibilities, contributions as well as potential impact of planned actions on women respective men, as the first essential step, before any decisions are taken; a focus on both women and men and the relations between them, especially in relation to access to and control over resources and participation in decision-making processes; explicit attention to gender perspectives,

making them visible and showing the links between gender equality and achievement of the overall goals of all sectors - if gender perspectives are not visible, it is not gender mainstreaming; moving beyond focusing on increasing the numbers of women participating to bringing gender perspectives to the centre of attention in analyses, policies, planning processes and resource allocations; and identification of the need for changes in goals, policies, strategies and actions, as well as institutional changes - changes in structures, procedures and cultures.

The link between gender mainstreaming and sustainable post disaster reconstruction has been highlighted by several studies. Yonder et al. (2005) explain that sustainability of reconstruction will not be achieved if policies and measures do not take into account equally the experience, knowledge, and interest of both women and men within society. Table 3 shows gender mainstreaming and its impacts on sustainability of post disaster reconstruction. The integration of gender mainstreaming within planning, reconstruction and evaluation brings many benefits. Promoting women and men voices within reconstruction planning improve awareness of them which is important as stepping stone for building sustainable reconstruction. Within reconstruction process, establishing gendered institutional capacity within reconstruction process to ensure equal access, participation and control between women and men within reconstruction process. Moreover, identifying and recognising structure, procedure and culture which may hinder women and men access to reconstruction process will enhance equality within affected communities. Evaluation is an important stage within reconstruction which is useful to identify whether the reconstruction outcomes bring benefits to communities. The result of reconstruction policy evaluation is also important for policy feedback. Bringing gender mainstreaming within this process not only ensures equal economic, social and environmental benefits of reconstruction for women and men, but also provides comprehensive information about negative effects of economic, social and environmental reconstruction both for women and men within affected communities.

Table 2: Gender mainstreaming and its impact on suitability of post disaster reconstruction

Sources: Khatun (2003); Yonder et al. (2005); Enarson and Chakrabarti (2009)

Reconstruction process	gender mainstreaming	impacts on sustainable post disaster reconstruction
Planning	<ul style="list-style-type: none"> • Ensuring gender perspective to assess reconstruction policy options. • Ensuring equal participation and voices between women and men within reconstruction planning. • Awareness of women and men needs and concerns within reconstruction planning. 	<ul style="list-style-type: none"> • Women and men are aware with reconstruction planning. This is important as stepping stone for sustainability of reconstruction.

Reconstruction	<ul style="list-style-type: none"> • Establishing gendered institutional capacity within reconstruction process. • Ensuring equal access, participation and control between women and men within reconstruction process. • Identifying and reducing structure, procedure and culture which may hinders women and men access to reconstruction process. 	<ul style="list-style-type: none"> • Reconstruction projects that address women and men rights, aimed at improving their well-being. • Women and men are more care with reconstruction projects.
Evaluation	<ul style="list-style-type: none"> • Ensuring equal economic, social and environmental benefits of reconstruction for women and men. • Identifying and reducing negative effects of economic, social and environmental reconstruction both for women and men. 	<ul style="list-style-type: none"> • Improving women and men well-being. • Establishing reconstruction sustainability and community resilience.

There is also evidence that demand-driven, participatory, inclusive approaches to reconstruction that empower women lead to more efficient and sustainable programmes (Enarson and Chakrabarti, 2009). Gender mainstreaming enhance productivity and income for families, and, more equitable access to reliable infrastructure services contributes to poverty reduction, growth, has positive impacts on health and empowerment within affected regions. These integrated approaches also increase access to markets, access to education, skills training and economic opportunities, business and other information and reduces the time required for domestic tasks (World Bank, 2007). They can reduce women and child mortality by providing timely access to health services, potable water and improved sanitation. Accordingly, the next section presents experience of mainstreaming gender within sustainable post disaster reconstruction from some disaster affected countries.

Mainstreaming gender within sustainable post disaster reconstruction: examples from developing countries

Studies provide evidence the benefits of mainstreaming gender for enhancing sustainability of post disaster reconstruction. Yonder et al. (2005) found how gender mainstreaming enhances social, economic and environmental sustainability of reconstruction at Marmara Turkey and Maharashtra India. In Marmara Turkey, they found that creating formal spaces where women's groups can organise to participate in reconstruction and formally allocating resources and roles to groups to involve reconstruction process is important to achieve sustainability of reconstruction. Poor women whose homes had been destroyed circulated, searching for ways to ensure the safety and survival of their families. They were looking for food, collecting usable items, talking to the press, and caring for their families and the injured. In *Tent* cities, women attended community meetings and interacted frequently with

settlement administrators and local government representatives to obtain information and access to aid. They tried to raise money for their families, by selling handicrafts or by preparing and selling food from their tents. Women groups also formed savings and credit groups and initiated partnerships with local agencies to ensure the financial sustainability of their centers. Tenants organised around housing cooperatives to find a solution to their housing needs. Moreover, small groups of women leaders participated in regional and international peer exchanges. These meetings gave them confidence to act as grassroots experts on microcredit schemes, housing processes, information gathering, and on the establishment and operation of centers for women and children.

In Maharashtra India, Yonder et al. (2005) show that women groups could inform, motivate, and supervise local homeowners. These groups provided hands-on leadership training with more than 1,000 village women appointed by the *Mahila Mandals*. Women were taught the basic construction techniques used for adapting and strengthening traditional village houses and learned how this type of construction would protect residents from future tremors. The information assistants and women groups took their responsibilities to homeowners and community groups seriously and worked to ensure that people knew how to access and use their entitlements and understood and were able to supervise the use of earthquake-safe features in construction and make use of appropriate technology and local resources. They worked, as well, to involve women in planning and designing their houses and interacted with government agencies on behalf of their communities. Since the women took the initiative to engage themselves, the government started understanding the problems better.

Krisnaraj (1997) shows how women are more active for supervising, monitoring and even undertaking construction following *Latur* Earthquake in India. Women go from house to house to encourage others to take up repair; monitor the subsidy provided by the government in instalments; see that the engineers who have to estimate the damage and certify construction do so; check corruption among these officers, and so on. Women participate in the construction of community buildings and model houses, in education campaigns on earthquake-resistant technology and checking erring officials. They have organised the collective purchase of materials. This has been an inspiring saga of the strength and energy of women's groups. Wherever they have worked, the rate of completion of houses has been very successful. Women also talk knowledgeably about beams, lintel, plinth, brackets, retrofitting and related technical terms. They can say whether a house has been constructed properly. They have designed their own houses with modifications-like where to put shelves, and what spaces they need. In some cases women have created their own drainage system, attaching a small pipe to a cement tank built inside the bathroom, which serves as an outlet and feeds the kitchen garden.

Study of International Federation of Red Cross and Red Crescent Societies (2007) shows the advantages of mainstreaming women into reconstruction process in Pakistan and Bangladesh. In Pakistan, enrolling women groups within reconstruction contributes to better performance and acceptance of the programme because they are more knowledgeable about local norms and beliefs. It is very important for the programme staff to have knowledge of the prevailing cultural values, traditions and the interests of the target community before designing activities to realize maximum benefits. Advocacy and strong leadership in gender-sensitive programme activities are key elements for ensuring sustainability and

lasting results, since it is very common for organisations to focus on saving lives during times of emergencies and to not give gender needs and issues adequate consideration. Youth and volunteer projects endeavour to expand the female volunteer base. The youth policy addresses the inclusion of gender equity in the volunteer base. Recognising and reducing security risks incurred by women make them more willing to participate in programme activities.

In Bangladesh, setting targets and quotas and using related promotional strategies has been important to the recruitment of greater numbers of female volunteers in the reconstruction policies. This is especially significant in the context of the targeted areas because there are fewer men than women in these communities, as many have migrated elsewhere to find employment and women ultimately must play a leading role in community-level disaster preparedness and response. The approach of holding combined monthly and bi-monthly meetings with male and female volunteers and the programme officer has made it easier to concentrate on finding solutions to the problems they face in the community. The involvement of local political, community, and religious leaders has a profound impact on effective programme implementation in the community, including the acceptance of women participation. Having a significant number of women participate in disaster risk reduction efforts strengthens the overall positive outcomes for communities' reconstruction.

Tanesia (2007) studies women role within post disaster reconstruction at *Meulaboh* Aceh Indonesia. Women have succeeded in organising themselves to fulfil their domestic needs. For example, after the tsunami, these widows' capability to organise proved very helpful in the process of reconstruction and rehabilitation. All members of women group organisation instantly set up shelters and public kitchens, and organised aid distribution. When these groups became the door and conduit for aid, the women exercised more control in managing aid coming into villages and were able to pay attention to all of women needs. World Bank (2008) documented Women participation within reconstruction process at *Bantul* Indonesia. The women organised themselves and made a savings and credit organisation which provides women with business capital in order to restart their daily economy. Business groups were established and proved helpful in obtaining additional income for families. This study also shows that having a strong gender policy framework is important for achieving gender integration objectives. Promoting the participation of women in reconstruction programme, and providing quotas for community volunteers are effective ways of challenging the existing power dynamics while at the same time promoting the participation of women in decision making, thereby giving them shared access to, and control over, project resources.

From those examples, it shows that mainstreaming gender within post disaster reconstruction enhances development effectiveness and sustainability. Hence, sustainable reconstruction and development can only be achieved if the interests and needs of women and men in society are taken into account and the potential of all groups is released. Both women and men have important roles within reconstruction, but women are often marginalized. Hence, responsiveness to women' needs and concerns are the core of sustainability. However, to achieve these awareness need some pre-requisite conditions.

How can gender mainstreaming be incorporated within sustainable post disaster reconstruction?

Lessons learn from gender and post disaster reconstruction in Marmara Turkey, Maharastra India, Pakistan, Bangladesh and Indonesia, it is identified that making gender mainstreaming works into sustainable post disaster reconstruction needs some pre-requisite conditions. Table 4 shows pre-requisite condition for mainstreaming gender into sustainable post disaster reconstruction and development. First, planning for reconstruction must be based both on women and men concerns and interests. By identifying the different women and men concerns and interests have it is possible then to translate them into planning needs by which their concerns may be satisfied. From this the requirements for gender policy and planning can be formulated, and the tools and techniques for implementing them clarified.

Table 4: Pre-requisite condition for mainstreaming gender into sustainable post disaster reconstruction and development

Pre-requisite conditions	Details
Awareness of gender needs and concerns within reconstruction and development planning	By identifying the different interests women and men have it is possible then to translate them into planning needs.
A strong gender policy framework	A systematic and pro-active approach to gender integration applied throughout all stages of reconstruction can have many positive results and create a better balance in meeting the needs and priorities of male and female beneficiaries.
Engaging women participation	Identify the barriers to women's participation in reconstruction and community leadership positions, and form a systematic strategy for overcoming these barriers.
Involving women leadership as an agent of change	Leadership for reconstruction and development often requires principally feminine attributes such as cooperation, holistic thinking and intuitive decision-making.
Gendered institutional capability	Mainstreaming gender within sustainable post disaster reconstruction need to provide adequate funding and human resources capability to discuss gender approaches in an environment.
Flexible and decentralised structure of gendered policy planning	The design of reconstruction needs to be flexible enough to adapt to lessons learned during implementation of reconstruction

Sources: Khrisnaraj (1997); Yonder (2005); UNISDR (2006); Enarson and Chakrabarti (2009)

Second, having a strong gender policy framework is important for achieving gender integration objectives into sustainable post disaster reconstruction. A systematic and pro-active approach to gender integration applied throughout all stages of reconstruction can have many positive results and create a better balance in meeting the needs and priorities of both male and female beneficiaries. The way in which a reconstruction programme is designed and implemented influences the degree to which women and men can actively participate and contribute. Women and men need to be fully consulted at every stage of design and implementation to ensure that the activities are responding to their needs and circumstances.

Third, there is a need to engaging women and men participation. Identify the barriers to women's participation in reconstruction and community leadership positions, and form a systematic strategy for overcoming these barriers. Create a gender-friendly environment for volunteers. This could include providing more opportunities for female staff and volunteers to participate in disaster management work in the field. The careful use of targets or quotas for participation by women and other socially excluded groups in decision-making bodies and training opportunities can be an effective way of ensuring that they do not get left out. It also needs to be recognised that this action alone will not necessarily lead to an increase in women's participation in decision-making. Supporters - including respected community leaders and members - may need to be identified to encourage a change in the way things are done. Gender sensitivity education may need to be provided to peers, and support may need to be given to women for them to develop the skills to successfully play what may be new and challenging roles for them. Achieve equal staff numbers of men and women require systematic and pro-active approaches to identify the socio-cultural barriers to women's participation in the formal labour force and to develop specific strategies to overcome these barriers. Gender objectives, targets and performance indicators need to be incorporated into the reconstruction log frame or other key progress and performance measurement tools and systems. The collection and analysis of gender-disaggregated data in monitoring and reporting needs to be reinforced by women leaderships, and necessary follow-up on any issues identified.

Fourth, the design of reconstruction needs to be flexible enough to adapt to lessons learned during implementation of reconstruction, such as the Bangladesh case experience of needing to change the way in which latrine construction and maintenance training was delivered to ensure that it better responded to the different roles of women and men. A gender analysis showed that local taboos and customs meant that men were predominately participating in trainings involving latrine construction and maintenance even though women were the ones primarily responsible for their cleaning and upkeep. Therefore, in its second year, the reconstruction phase plans to conduct separate training courses in latrine construction and maintenance for men and women. Once people have an increased understanding of the importance of addressing sanitation issues, combined male and female training will be more acceptable.

Conclusion

This paper aims to elaborate the link between gender mainstreaming and sustainable post disaster reconstruction and development. It shows that sustainability of post disaster reconstruction and development will not be achieved if policies and measures do not take into account equally the experience, knowledge, and interest

of both women and men within society. By integrating a gender mainstreaming into reconstruction, policy makers have valuable information to understand the possible effects of policies and measures developed for reconstruction on gender roles, which are needed for better and more sustainable reconstruction. However, pre-requisite conditions are needed to integrate gender mainstreaming works into sustainable post disaster reconstruction. Lessons learn from the case of gender and post disaster reconstruction, this study finds pre-requisite conditions for integrating gender mainstreaming within sustainable post disaster reconstruction as: awareness of gender needs and concerns, a strong gender policy framework, women participation and leadership as an agent of change, gendered institutional capability, flexible and decentralised structure of gendered policy planning.

The way forward

This paper focused to elaborate the link between gender mainstreaming and sustainable post disaster reconstruction. This is a part of my on-going work at the beginning my 2nd year of the PhD. The next step of this work is that to elaborate each pre-requisite condition for mainstreaming gender within sustainable post disaster reconstruction. Based on these, strategies for mainstreaming gender within sustainable post disaster reconstruction will be identified.

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Appendix 1: Summary of gender policies experiences in five countries

Locations	gender policies	outcomes	key factors
<i>Marmara, Turkey</i>	Promoting women groups and leaderships within housing and economic reconstruction.	Better allocation housing reconstruction and enhance economic well-being of communities which enhance financial sustainability of affected communities.	<ul style="list-style-type: none"> • Strong key leaderships. • Cooperation between women groups, local governments and donors. • Active involvement of women groups within reconstruction process • Training and women leadership training for enhancing gendered institutional capability.
<i>Maharashtra, India</i>	Promoting women groups and leaderships within housing and settlement reconstruction.	More appropriate technology and local resources as well as better house design which accommodate women and men needs at affected regions.	<ul style="list-style-type: none"> • Flexible design of reconstruction policy and planning. • Leadership training for enhancing institutional capability. • Cooperation of women groups, government and donors.
<i>Latur, India</i>	Promoting women groups and leaderships within housing and irrigation reconstruction.	More appropriate house design and establish more transparent reconstruction governance.	<ul style="list-style-type: none"> • Support and cooperation between women groups, government, and donors. • Active involvement of women groups within reconstruction process.
<i>Pakistan</i>	The inclusion of gender policies within housing reconstruction and secure community.	Better performance and more acceptances of reconstruction programmes.	<ul style="list-style-type: none"> • Women groups' and institutional capability. • Strong key leaderships. • Existing active women groups within affected communities.
<i>Bangladesh</i>	Setting targets and quotas for women participation within reconstruction process.	Effective reconstruction programme including the acceptance of women and men within community reconstruction.	<ul style="list-style-type: none"> • Support from local political, community and religious leaders. • Participation of women groups within affected communities.
<i>Meulaboh, Indonesia</i>	Promoting women participation for budgeting allocation and transparency of reconstruction.	Enhancing economic well-being and better allocation of aid distribution.	<ul style="list-style-type: none"> • Flexible design of reconstruction policy and planning. • Availability of resources and funding. • Participation of women groups within affected communities.
<i>Bantul, Indonesia</i>	Promoting women participation within economic reconstruction.	Enhancing economic well-being and sustainability of reconstruction outcomes.	<ul style="list-style-type: none"> • Existing gender policy framework. • Cooperation between women groups, local government and donors. • Existing women groups and leadership which support reconstruction process.

Sources: Yonder et al. (2005); Krisnaraj (1997); Tanesia (2007); IFRCs (2007)

Soap Based Thermal Insulation: A Sustainable Alternative to Petroleum Insulations

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Abstract

The thermal insulation market is dominated by petroleum insulations. A gap has been identified for the manufacture of “green” insulations. These insulations must perform to the same levels of heat transfer resistance as their petroleum based counterparts. Modern petroleum derived insulations can be carcinogenic, toxic to manufacture and release toxins as they degrade. The majority are not environmentally friendly. The aim of this research is to create an insulation that combats the above points and addresses the gap between sustainable and non-sustainable insulations. This research will address the uncertainties in the alternative insulation validation process, achieved through experimental research. Soap will be manufactured from lye, animal fats and oils and aerated to produce soap insulation. These manufactured soap samples will be tested in both laboratory and real-world settings. Soap insulation could be a useful addition to low environmental impact insulations and create a foundation for further research to build off.

Keywords

Petroleum Based Thermal Insulation, Soap Based Thermal Insulation, Sustainability, Lye, Oils

1. Introduction

The research aim/objective is to manufacture a sustainable thermal insulation, derived predominately from waste products that can be used as an alternative to petroleum based insulations. The problem is whether aerated soap can perform to the same increased efficiency levels as its chemical based counterparts, whilst decreasing the environmental costs of fossil fuel retrieval, plastic manufacture and end of life waste disposal. Soap insulation, derived from soap in its most basic form, (fats, oils and wood ash residue) is natural (Grosso, 2002) and could be one possible advancement in a quest to encourage sustainable building. Combining fats and lye will create a hard, crude soap mixture that once aerated and left to cool can be cut into slabs and surrounded in recycled plastic to create thermal insulation products. Trapped bubbles within the insulation will give the insulation its thermal properties (DeGunther, 2010). In order to satisfy the objective, 4 methods of research must be satisfied:

1. Refining the gathered evidence and identifying the limitations of the methods used.
2. Collecting, organising and interpreting the data to determine the best way forward, through experimental research.

3. A research strategy to ensure that the design of the study strategy is appropriate to achieve the research objective.
4. A manufacturing process of continual improvement through experiments and literature reviews of existing thermal insulations.

1.1: Background to Thermal Insulation

There are four main types of foamed plastic wall, floor and roof insulation that are commonly used within the construction industry. Alongside these, multi-layered reflective foil and fibreglass insulations are also used. Green, sustainable insulations are becoming more popular, but occupy a very small niche in the market generally. The six main insulation types are as follows:

1. Extruded polystyrene (XPS)
2. Extruded polyethylene (XPE)
3. Expanded polystyrene (EPS).
4. Polyurethane (PUR) and polyisocyanurate (PIR)
5. Fibreglass
6. Multifoil

Sustainable thermal insulation products derived from paper, wool, hemp and cotton fibres have recently become available for use, although these “green” products occupy a somewhat limited niche in the marketplace.

1.2: Potential Environmental Problems with Insulation manufacturing

1. On an environmental level, the impact of petroleum based plastics and refined oil is threefold. 1. The retrieval of oil cannot be considered as sustainable. The limited supplies remaining and the damage caused to the environment by retrieval, is in direct opposition to the “green” energy alternatives.
2. The refining process of crude oil and the processes involved in plastic and foamed plastic insulation component manufacture, involve high greenhouse gas output emissions as a by-product and high energy consumption throughout the product’s start to finish manufacturing ratios. The refining process relies on the combustion of fossil fuels for this heating, whilst the recovery units emit large amounts of methane and carbon dioxide, making the oil refining industry a significant source of emissions (Worrell & Galitsky, 2005).
3. End of life disposal of the insulation products can have a negative impact on the natural environment. Traditional insulations are difficult to dispose of in an ecologically friendly manner. In the UK, the majority of waste insulation finds its way to landfill sites where it can leach toxins into the soil as it degrades (Rogers, 2005).

2. Experimentation of Soap Production through Stages

Soap insulation must satisfy certain criteria in order for it to achieve mainstream acceptance. In order to satisfy the criteria, various obstacles must be overcome. Primarily, melted fats or oils must be turned into a solid. First, it would be useful to know the definition of oil and fats. Fats are the oily substance occurring in the adipose tissue of some animals and in the fruits, nuts and seeds of some plants. They are usually solid at room temperature (Joachim, 2001). Oils have the same chemical structure as fats, but are usually liquid at room temperature.

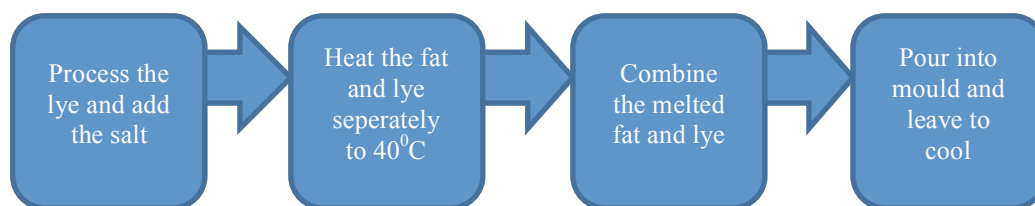


Fig.1: Soap Development Process. (Read, 2012)

2.1. Stage 1: Lye Production

Lye Description

Burnt wood residue (ash) left to leach in water for a number of days will change the water into a hydroxide alkaline solution known as lye (Tro, 2012). This caustic solution is a strong corrosive metallic base (Tro, 2012). Sodium hydroxide [NaOH] and potassium hydroxide [KOH] can both be extracted from wood ash, although wood ash typically contains up to 10 times more potassium than sodium (Journey to forever, 2011). It should be explained that both sodium and potassium are soft white metals, in this case derived from common salt (sodium chloride) and potash (Clegg et al, 2002).

Manufacturing the Lye

It should be noted that the experimentation of soap production was done by the author. Soap insulation research is unique, as demonstrated by the awarding of a patent on the idea. As such there is little literature to reference. Potassium hydroxide was created by adapting the instructions given on the website “Journey to Forever” (2011). Oak branches were burnt because hardwoods leach more lye than softwoods. (Journey to Forever, 2011). The ashes were then collected. A barrel was sourced and a 100mm covering of gravel was placed inside the bottom. 150mm of hay was placed on top of this gravel. This was the filtration system. A small hole was drilled into the bottom of the barrel and a cork fitted to act as a plug. 10 litres of ash was placed into the barrel and 30 litres of rainwater poured over the ash and allowed to settle. The resulting mixture was allowed to sit for seven days, with occasional stirring. The water was then drained off, strained through a nylon sieve and then filtered into a jar.

2.2. Stage 2: Initial Coarse Soap Output in the Soap Production Process

A potential of hydrogen test was carried out on this lye liquid and the mixture was confirmed as alkaline registering a confirmation of 14 on the indicator testing strip. 125g of lye was then placed into containers for use in the manufacture of the soap test samples. Two soap samples were manufactured using the ashes derived potassium hydroxide and beef fat (125g of KOH and 250g of fat). One sample was blended and left to solidify. 40g of common salt was added to the other sample, then blended and left to solidify. The results were as follows:

- The potassium hydroxide soap without the added salt set to a semi solid state, somewhere between a liquid and a solid.
- The potassium hydroxide soap with added salt (In effect the KOH now converted to NaOH) set solid over a 10 minute period. The manufacturing process was repeated with each of the following fats: beef fat, pork fat, palm oil, used waste

vegetable oil and used waste engine oil. All of the samples were mixed as per the following proportions: 250g of fat/oil and 125g of sodium hydroxide, and the “cold process” method was used for the manufacture. The soap setting time results are shown in Table 1.

2.2.1: Results for the Initial Soap Production (different fat types)

Table 1: Soap setting times. (Read, 2012)

Oil ingredient	Time achieve trace	Setting time (solid)
Beef fat	90 seconds	10 minutes
Pork fat	2 minutes	1 hour
Palm oil	5 minutes	1 hour
Waste vegetable oil	6 minutes	30 hours
Waste engine oil	12 minutes	60 hours*

As can be seen from the “soap setting time” table, Beef, pork and palm oil have similar consistencies and create soap over a broadly similar time-frame. This is because the proportions of fats within the oil have a direct bearing on the length of time required for the soap to set hard. It should be noted that the waste engine oil used in the soap sample failed to set into a hard solid soap, but instead into a soft, flexible, “rubbery” material (Shown in Fig.2). It was decided that further research into soap insulation using waste engine oil as the base would be discontinued at this stage, with possible further research in the future. Soap samples manufactured from the other four oils set hard (see Fig. 3) on the following page.



Fig.2: This waste engine oil soap remained in a “blancmange” state. (Read, 2012)



Fig.3: A block of hard, solid, waste vegetable oil soap. (Read, 2012)

2.3. Stage 3: Improving the Course Soap into the Lightweight Soap

2.3.1: Selection of the Cold Process Over the Hot Process for the Soap Manufacturing

The cold process soap manufacturing method is the method used for the research experiments in this report. This method is chosen over the “hot process” because of the speed in which the soap reaches saponification (5 minutes as opposed to 3 hours). The cold process involves adding measured amounts of lye to water and mixing it with heated oil, whilst both ingredients are stabilized at a temperature of 40⁰ C. The mixture is blended until it thickens (achieves trace) and then poured into a mould to set (Palmer, 2007). The hot process requires the lye and oil mixture to be cooked (alternating heating and cooling) for three hours in a slow cooker, poured into moulds and left to harden (Grosso, 2003). This method boils off excess water from the mix and negates the need to mix the lye and oil at the precisely the same temperature (40⁰C). In both processes the saponification setting action reduces the lye soap mixture from a highly alkaline substance to one that is pH neutral.

2.3.2: Making the Soap Lightweight

As stated previously, mixing oils and lye will create a hard soap mixture that once cooled can be cut into rigid boards and surrounded in plastic to create thermal insulation. The air bubbles within the soap should give the insulation its thermal properties. The arrangement of the molecules within these air pockets is such to utilize air as the insulator.

In order to make this product lightweight (and thermally efficient), it was necessary to aerate the mixtures. The mixing ratios listed previously were used in the manufacture of the following test samples and the weight and weight differential was recorded in fig.4. Various methods of aerating soap were tried. These included the addition of paper fibre balls, polythene balls, ice spheres, straw, expanded Expancel microspheres and sodium bicarbonate. The methods used to manufacture the test samples are shown on the following section.

2.4. Stage 4: Improving the Lightweight Soap with Various Additives

2.4.1: Soap with no Additives (Control Soap for Benchmarking)

A sample of soap was mixed using the following ingredients. 250g beef fat and 125g of lye. This was an identical ingredients mix as was used for the subsequent soap batches, but in this, no aerating additives were included. This soap with no additives was used as the control.

2.4.2: Soap with Added Straw

Another method of creating a lightweight aerated sample was the introduction of short fibres of straw into the mix. Straw is hollow and is a good insulator. It is a by-product of farming and is totally biodegradable. For the soap experiment, 15g of Straw cut into lengths of 10mm - 15mm were added to a soap sample mixture. The additive equated to 50% of the soap mould's cubic volume.

2.4.3: Soap with Added Expancel

Yet another method of aerating the soap was the introduction of *Expancel* microspheres. These microspheres are tiny copolymer and isobutane spherical particles that expand to many times their original size by the introduction of heat. However, for the heat process to work, the mixture that the spheres are introduced into must reach a temperature of 80⁰C -250⁰C (Expancel, 2011). However, soap temperature when mixing and setting peaks at around 50⁰C. It is the heat that triggers the spheres' expansion. Already expanded microspheres can be introduced into a mixture though. This addition not only aerates the mixture, but also gives the finished structure compressibility and lightweight properties (depending on the amount introduced), ideal for insulation products. The one drawback of using Expancel is that the insulation product is no longer *entirely* natural, recycled or chemical free. For this soap mixture, as with the other test samples, the soap ingredients were of identical proportions. The water was heated to 100⁰C in order to initiate a reaction from the Expancel powder. The Expancel was weighed at 0.5g (4 tablespoons) and added to the water and lye mixture. The normal process of blending to achieve trace, and the pouring of the liquid soap into the mould to cure was completed. The weight of the product was recorded one week later.

2.4.4: Soap with Added Paper Spheres

Small, hollow, dried waste paper based spheres can be introduced into the soap mixture in place of straw. These can be lightweight cellulose fibres and of the type normally used as stabilizing additives to stone mastic asphalts and hot rolled asphalts (highways), or the more paper based, as used in art and craft hobbies. The paper can be recycled from low quality products such as newspapers etc. The size of these particles is typically 10mm – 15mm.

An identical base mixture as listed previously was created, but this time with the addition of 37g of 15mm paper balls. This 37g equated to approximately one half of the soap mould cubic area by volume. This left a sufficient volume of soap to bind the mixture together for the product strength.

2.4.5: Soap with PEHD Spheres

An alternative to paper is to use small (10mm) hollow plastic balls made from waste PEHD. These are also extremely lightweight and should also give the insulation good thermal properties. This batch of soap was made in an identical way as the

previous ball additive soap, only this time the paper balls were replaced with 25g of 10mm PEHD hollow spheres.

2.4.6: Soap with Added Ice

The rationale behind this idea was that ice particles would be another method of aerating the soap. Small ice spheres would be substituted for the straw, paper and “Expancel”. The ice would be introduced into the mix and as the temperature of the soap increased, and thus solidified, the melted ice would leave air pockets throughout. This should give the product lightweight properties.

Once again, another batch of soap was mixed but this time 10mm ice cubes were added as an ingredient. The ice was added to a batch of trace soap liquid but the soap immediately solidified on contact (with the ice). A test liquid soap mixture was introduced to a container of cold water and this soap also solidified instantly. Further investigation of ice added to the soap was discontinued.

2.4.7: Soap with Added Sodium Bicarbonate (NaHCO_3)

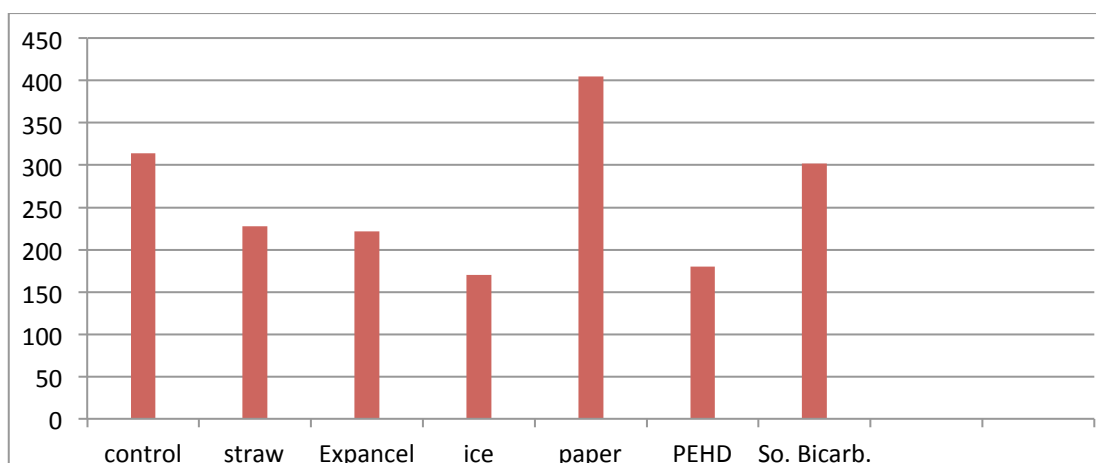
Aerating with an alternative, more natural additive was tried next. A bicarbonate of soda (baking powder) and vinegar foaming agent was compiled, at a ratio of two teaspoons to four respectively. This mixture foamed violently immediately the vinegar and soda came into contact with each other. This froth was introduced into the soap at the soap’s liquid stage, after trace had occurred so as not to let the bicarbonate mix interfere with the actual saponification process (where the fat and lye combined to form the soap). The mixture was blended together and left to cure.

Observation revealed the soap to have separated into distinct layers. Soap occupied the bottom two thirds of the soap mould with ponding on the top third. The top third was a clear liquid with a salt glazed surface. A potential of hydrogen strip revealed the liquid to be an acid with a pH of 5, whilst the soap below was alkaline with a pH of 13. The liquid was drained off and the soap was left to solidify. However, the soap failed to set firm and remained in a gel state. It also remained in a highly alkaline state.

In effect the addition of the blowing agent had separated the soap into three distinct layers, alkaline at the bottom, acid in the middle and salt on the top surface. Research using this type of mixed foaming agent was discontinued, with the next batch mixed using just sodium bicarbonate alone, in its powdered form. When compared with the control (soap with no additives), the sodium bicarbonate soap was slightly lower in weight than the control. However, the soap did not set hard enough to be considered for use as an insulation material. The soap structure had been considerably weakened by the addition of sodium bicarbonate and so this product was deemed unsuitable for purpose and further research into this particular product was halted.

2.5. Stage 5: Comparative Analysis of Aeration Methods with the Control Soap

Following manufacture the soap samples were dried and a moisture content reading was taken for each sample. When all of the samples had an identical reading of 35%, the samples were weighed. The results are recorded in the bar graph on the following page (Fig.4).



The vertical axis shows the weight in grams

Fig. 4: Soap weight graph shows how additives affect soap weight. (Read, 2012)

The table below (Table 2) shows the weight percentage difference between the control soap and the soaps with the aerating additives.

Table 2 Weight Difference Between soaps. (Read, 2012)

Paper balls*	29%	Heavier than the control
Plastic balls	43%	Lighter than the control
Ice balls*	46%	Lighter than the control
Straw	27%	Lighter than the control
Expancel	29%	Lighter than the control
Sodium bicarbonate*	4%	Lighter than the control

*Discontinued from further study.

Results showed that soap with added paper balls increased in weight. There is a possibility for this. The lightweight paper balls absorb and retain moisture from within the mixture, thus trapping the moisture inside of the sample, whilst the rest of the soap dries out.

The worst performers, soap with the paper balls, ice and baking powder were discontinued from this study with a view to possible investigation in the future. Out of the six samples tested, only three moved on to the next stage.

2.5.1: An Alternative Method of Aeration

Another batch of soap was mixed and was aerated using a method that is employed sometimes when making aerated chocolate (Barrett, 2012). This method would be to introduce air into the mixture under pressure. This would take place in a hermetically sealed container, with the air being sucked out from this container, creating a vacuum inside. This removal of air should create bubbles within the soap before it solidifies. Some brands of bubble chocolate have air introduced into the bar in this way (Chocablog, 2010).

The soap mixture was poured into a compressed gas (nitrous oxide) whipped cream dispenser. The soap was then fired under pressure into a plastic box with a sealable

lid (the lid had a previously cut 5mm hole through its surface). The box was placed into a PVC vacuum bag and the bag opening zipped closed. The vacuum hole in the bag was aligned to the hole in the box lid. A vacuum cleaner sucked the air out of both the bag and the container. The bag was placed into a fridge for 1 hour and then removed. The soap was weighed and the results were recorded (29% lighter than the control soap of equivalent cubic volume). The soap was then dissected to examine the bubble content (fig 5). Although the soap was aerated, the bubbles were small (approximately 1-3mm width generally). However, with the preliminary experimentation into aerating the soap successful, the way was clear to refine and expand on the results to improve its overall thermal efficiency capabilities.



Fig. 5: aerated soap created by the vacuum method. (Read, 2012)

2.6. Stage 6: Increasing the Elasticity of Soap

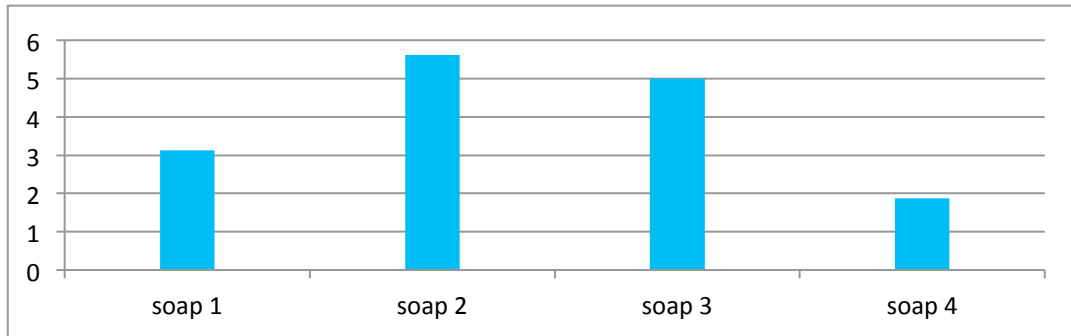
In order that the insulation can withstand on site knocks without breaking and retain its shape throughout its lifetime, the soap must be strengthened. In the test samples this was achieved by the addition of cotton thread fibres, added wool fibres and the addition of animal glue dispersed within the mixture at the soap's liquid stage before it hardens. Animal glue is natural and is derived as a by-product of the meat slaughtering industry (Gooch, 1997).

2.6.1: Soap with Added Glue

The object of manufacturing then testing the reinforced soap was to gauge the strengthening measures of the additives in the soap as a whole. (Tensile testing was also repeated, but on aerated soap this time. These results are recorded in fig.6, further into this chapter). One soap sample contained no strengthening measures, and this was used as the control. Different soaps will give different readings due to their ingredients and composition. Because of this, all four testing samples were made from the same batch of soap mixture. All four samples were sized at 100mm X 100mm surface area, 25mm thick. The tensile breaking points of each soap sample recorded in fig. 6.

2.6.2: Soap with Added Wool and Cotton Fibres

Wool and cotton fibres were added to the soap samples at the mixing stage. This addition was designed to improve the elasticity of the soap and improve its tensile strength. The strength testing results are also recorded in fig 6.



Side measurements are tensile strength measurements in psi. (lbs. per square inch)

Fig. 6: Failure of soap chart. (Read, 2012)

Soap 1: control (no additives)

Soap 2: Added wool fibres

Soap 3: Added cotton thread fibres

Soap 4: Added glue

The tensile strength of the soap samples were determined by using the following formula: The surface area (in inches squared) is subjected to applied loading (in lb's). The breaking point force was recorded. The applied load was divided by the soap surface area to determine the tensile strength of the soap.

As can be seen from the graph, soap with a glue additive fared the worst. On cutting into the soap it was revealed that the soap had a denser composition compared to "normal" soap. Research into this soap was discontinued with a view to possible investigation in the future. It was unclear at this stage if the woolen fibres would interfere with any future aeration procedures, and so it was deemed that the thinner cotton thread fibres would be preferable to use for the final insulation samples.

2.6.3: Tensile Testing of the Combined Reinforced and Aerated Soap

Aerated, reinforced soap samples were also used for the tensile testing and the results are shown in the table on below. The soap samples consisted of soap mixed as per the previous mixes, with the addition of cotton fibres for strength. The soap samples were aerated with straw, hollow plastic spheres, Expancel and the vacuum method as per the mixtures described in chapter 4.3-5. Once hardened the soap was tested to ascertain its tensile strength. All four samples performed worse than the un-aerated samples (shown in Fig. 6). The actual strength of each sample is recorded in Fig.7 below.

Soap 1: control (added cotton fibres but not aerated)

Soap 2: Added hollow plastic spheres

Soap 3: Added straw

Soap 4: Added Expancel

Soap 5: Aerated via the vacuum method

The results indicate that aerating the soap samples decrease the tensile strength of the soap, even when the soap has been strengthened. This could be a result of the aeration process making the soap less dense, which in turn makes the samples less

resistant to compressive force. The molecular bonding could be weakened because of the breaking up of the linear structure as the pockets of air decrease the structural integrity. The soap sample with the added plastic spheres fared the worst. This was because the soap failed to adhere the plastic to the same extent that it bonded to the straw and Expandel. Research into soap with the addition of plastic spheres was discontinued at this stage. However, research into the other three sample types was continued.

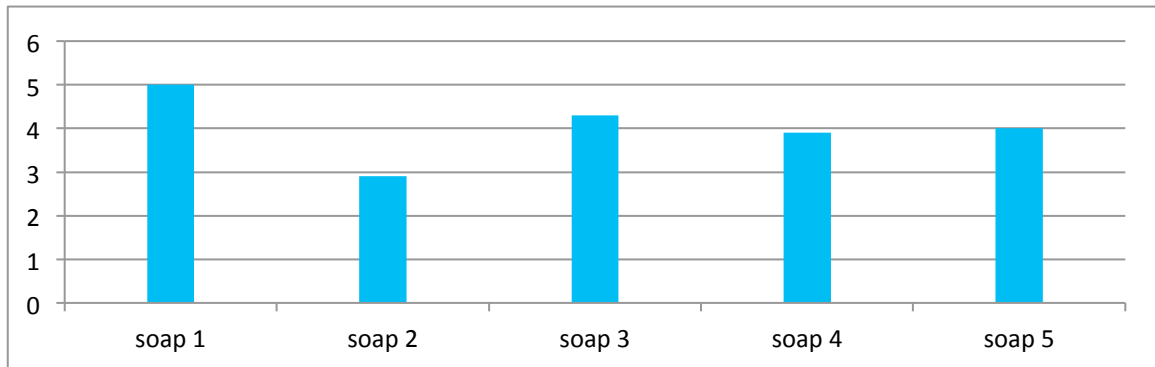


Fig. 7: Failure of soap graph. (Read, 2012)

Side numbers are tensile strength measurements in psi

3. Conclusion

Soap samples were manufactured using the cold process described previously into this paper. Both fats/oils and lye were combined to create solid soap. The samples were strengthened with the addition of cotton fibres, wool fibres and natural polymer glue. The samples were also aerated to create lightweight products. The best performing samples will be hot-box laboratory tested to ascertain the U-values, and then then tested for thermal efficiency in real-world situations.

No definitive conclusions as to whether soap based insulation will perform can be made at this stage as the research is still ongoing. Soap based thermal insulation is a new concept and the soap development processes are still evolving. Early indications reveal that soap can perform as a thermal insulation, but at what constitution and thickness is still to be determined. The thickness of the insulation to its application ratio will be a key factor for determining if the insulation will be marketable.

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Use And Evaluation Of The Envi-Met Model For Two Different Urban Forms In Cairo, Egypt: Measurements And Model Simulations

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Abstract

In order to achieve outdoor thermal comfort it is necessary to have a clear understanding of the interactions between the prevailing climate and the urban form in the lower part of the atmosphere which is directly influenced by local exchange processes and can develop an individual local climate, especially in urban areas where the great variety of different surfaces and sheltering obstacles produces a pattern of distinct microclimate systems. The paper presents a micro-scale numerical model for two different urban forms within the same alley for a hot summer's day in Cairo. Each urban form has its own configuration including different urban regulation, material, vegetation and H/W. In both cases, ENVI-met model output is compared with measurements resulting in an overall acceptable agreement of the model performance.

Keywords

ENVI-met, Microclimate, Urban planning, Thermal comfort

Introduction

As numerous studies stated that the world's average air temperature has risen between 0.3 °C and 0.6 °C since the late 19th century. In addition to the 4th IPCC Assessment Report, which showed evidence that Africa is warming faster than the global average, and this is likely to continue. This warming is greatest over the interior of semi-arid margins of the Sahara and central southern Africa.(IPCC, 2007). Warmer summer temperatures are expected to have a large impact on the quality of human life in urban quarters; these urban quarters differ from rural ones as they produce a pattern of distinct microclimate systems, which results in typical urban phenomena known as urban heat islands. Therefore the environmental quality of urban open spaces has become a fundamental subject (Hwang RL, Lin TP 2007, Lin TP. 2009, Huang L, Li J, Zhao D, Zhu J. 2008). starting with the study and description of microclimate processes, and passing by study focuses on microclimate research in relation to outdoor thermal comfort contributions such as those of Oke (1987), Bosselmann et al. (1995), Katzschner (2004), Matzarakis (2001), Moriwaki and Kanda (2004) and Stathopoulos (2006) which were interesting for designers as they addressed factors that can be changed through urban design interventions. However, the integration of the climate dimension in the design process is missing as a result of poor interdisciplinary work, as there is still a lack in supplying climate knowledge to improve design, (Oke 2006).accordingly, Givoni et al.(2003) highlighted the designers' need for a predicting tools to evaluate

the effect of a particular change in a climatic element on the comfort of person staying outdoor, and have the ability to process detailed environmental information according to time and location variations and to generate analytical results to reveal the relationship among the microclimatic environment, outdoor urban design and thermal comfort. In this study the microclimatic effects of two urban sites in the Islamic Quarter of Cairo is numerically assessed using the numerical model ENVI-met 3.1, which has approved its partial validity that enables master planes comparisons on an impact assessment basis.

Research settings

The Cairo zone lies between latitude 26° 50" N to 30° 45" N. In the middle of that area lies Al-Muizz Alley as seen in figure 1, which is the urban site examined in this paper. It is one of the oldest streets in Medieval Cairo, approximately one mile long. In the late 90's the UNESCO recognizing that Al-Muizz and its surroundings hold great historical and cultural value declared Islamic Cairo a protected world heritage site. A massive restoration project was commissioned by the Egyptian government, transforming the street into an open-air museum. The first part of the street was fully restored and was opened to the public in Early 2010. The second part of the Alley has yet to undergo restoration. The present study contrasts the ambient conditions for each part of the same alley through the ENVI-met numerical simulation as each part has its own urban distinctive features, regulation, materials, shadings, vegetation, and surfaces etc. The case study is kept under Dry Climates, which are characterized by modest rain and a vast daily temperature range (group B according to Koppen classification) and in almost lies entirely in the sub group: BWh - arid or desert with hot climate (Peel MC, Finlayson BL, McMahon TA, 2007)

Methodology

Microclimatic site measurements

Based on 30 years of WMO Station no.623660 records at Cairo international airport the small scale micrometeorology measurements were taken between 26th June and 2nd July 2012 representing the extreme hot summer. The physical parameters studied as stated in ASHRAE handbook are the air temperature, relative humidity, solar radiation and wind speed, in addition to globe temperature using the kestrel 4400 heat stress tracker. Figure 2 shows the instrument setup for measuring the four mentioned parameters. The measurement height was 1.1 m above the ground, corresponding to the average height of the centre of gravity for adults (Mayer and Hoppe, 1987). Figure 3 shows the two model domains as well as measurement points which was chosen to be representative of their respective neighborhoods, to validate the modeling output later on.

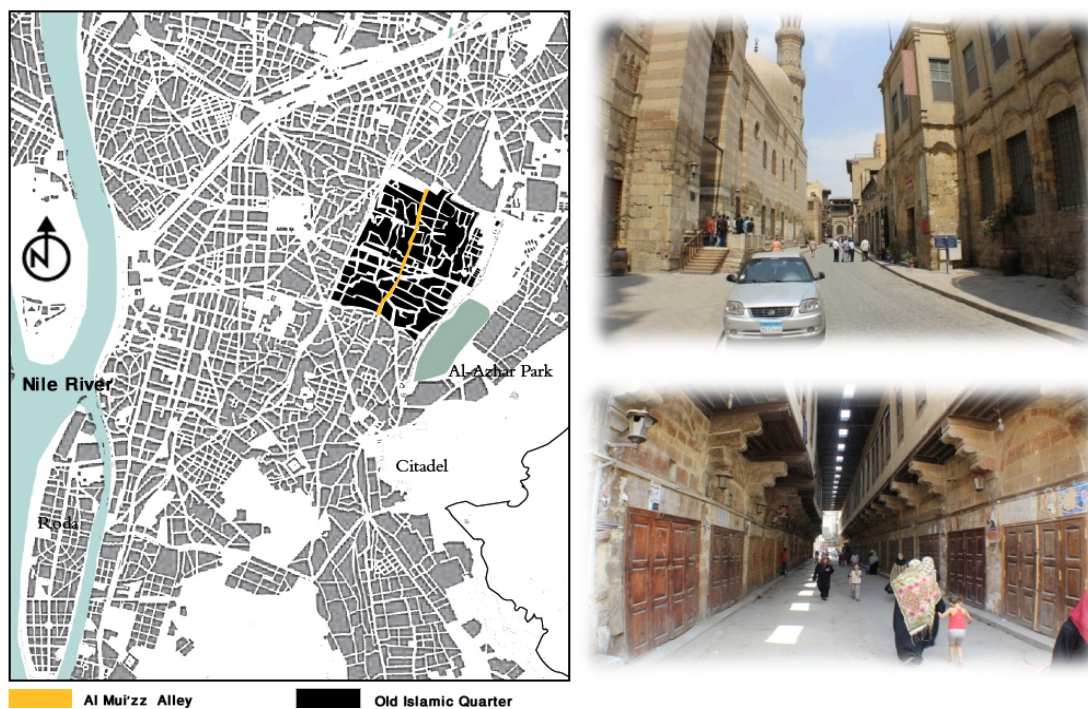


Fig. 1. Al Muizz Alley location on the left. The renovated part on the top and the non renovated on the bottom



Fig.2.the mobile weather station setup

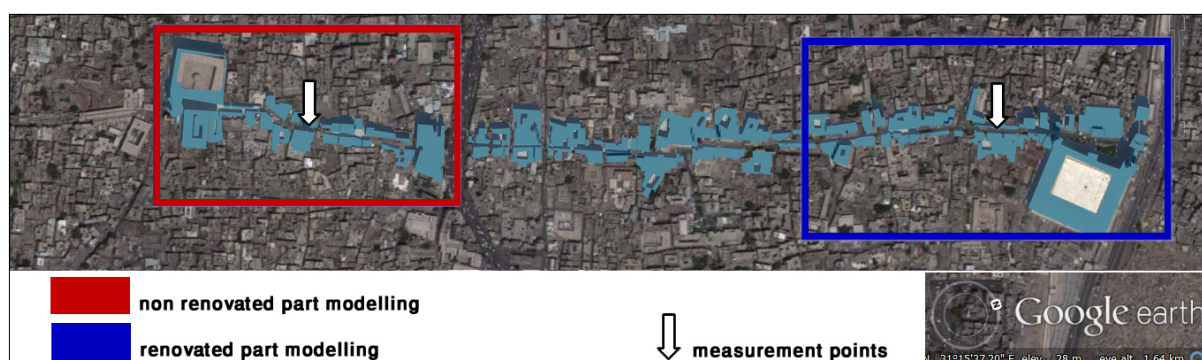


Fig.3 the 2 Modeling domains and the 2 measurement points

Numerical Simulation

The model simulations have been carried out with the three-dimensional non-hydrostatic climate model ENVI-met Version 3.1 (Bruse and Fleer 1998). ENVI-met can simulate the surface-plant-air interactions within urban environments with a typical resolution of 0.5 to 10 m in space and 10 sec in time. It calculates the dynamics of microclimate during a diurnal cycle (24 to 48 hours) using the fundamental laws of fluid dynamics and thermodynamics. The model includes the simulation of flow around and between buildings, exchanges processes of heat and vapours at the ground surface and at walls, turbulence, exchange at vegetation and vegetation parameters, bioclimatology, particle dispersion.” (www.envi-met.com). According to Lenzholer, S. (2010), it is the only software where all the factors influencing thermal comfort like wind speed and direction, and Tmrt, air temperature are simulated integrally to derive thermal comfort indices.

For the model simulations, the area around Al Muizz alley has been transformed into two models grid with the dimension 30 x 140 x 30 grids with a resolution of 1 m x 1 m x 3 m for the renovated part and the dimension 30 x 88 x 30 grids with a resolution of 1 m x 1 m x 3 m for the non renovated Note that the model area is rotated 15° out of grid north. Table 1 shows the simulation input data for the 26th of June 2012 which is the extreme summer day for Cairo. Two snapshot receptors were located at the same spots of the measurement campaign to record Ta, RH, V, solar radiation and Globe temperature at 1.2 m above ground level. Outputs were then compared with the local climate scale averaged records for the same parameters observed from the site measurement.

Table 1. Main input data used for ENVI-met

Parameter	Value
Ta, air dry bulb temperature	301.95 °K
RH, relative humidity	59%
V, wind speed	3.5 m/s at 10m height
soil temperature	302 at (0-0.5m) and 299 at (0.5-2m)
U value walls	1.7
U value roofs	2.2
Albedo walls	0.4
Albedo roofs	0.15

Results and Discussion

Figure 3 shows the comparison between the observed air temperature at the two measurement points in 1.1 m a.g.l and the corresponding model results at 1.2 m a.g.l (due to the vertical model resolution). The data show the results from the in-depth campaigns started at 6:00 and lasted for 18 hours. Two model simulation outputs are plotted against the data observed for the two parts of Al Mui'zz alley. ENVI-met

estimation for the dry air temperature (T_a) were in a good approximation with the observed one in both parts as shown in figure 3. The air temperature (T_a) for the observed and Modeled reached their peak in the afternoon, between 11 a.m. and 3 p.m. in the renovated, the observed was between 33 °C and 33.69 °C and the ENVI-met air temperature 31.27 °C and 30.95 °C respectively. In the non-renovated part, the observed was between 31.68 °C and 35.65 °C and the ENVI-met air temperature 30.12 °C and 30.03 °C respectively.

Relative humidity in figure 4 also showed a good agreement between the RH observed from the site measurement campaign and the RH generated by the ENVI-met, as they reached their maximum in the late morning between 6 am till 10 am for the renovated part where the observed RH was 72% and 50% corresponding to ENVI-met estimation which was 66% and 58% while for the non renovated was 78% and 56% against 64% and 64% as ENVI-met values.

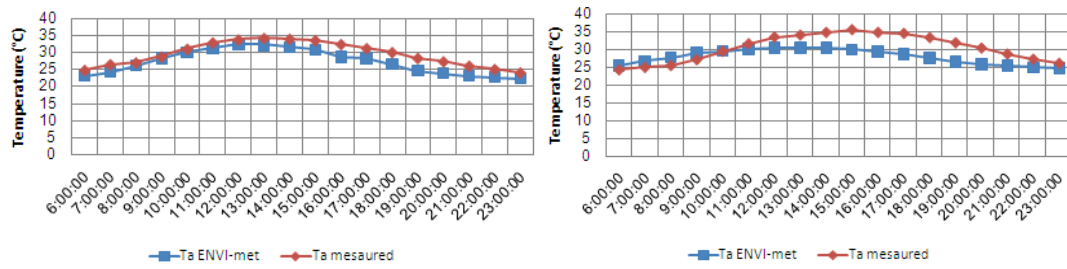


Fig.3. comparison between the dry air temperature measured and the ENVI-met output for the renovated (left) and non-renovated (right)

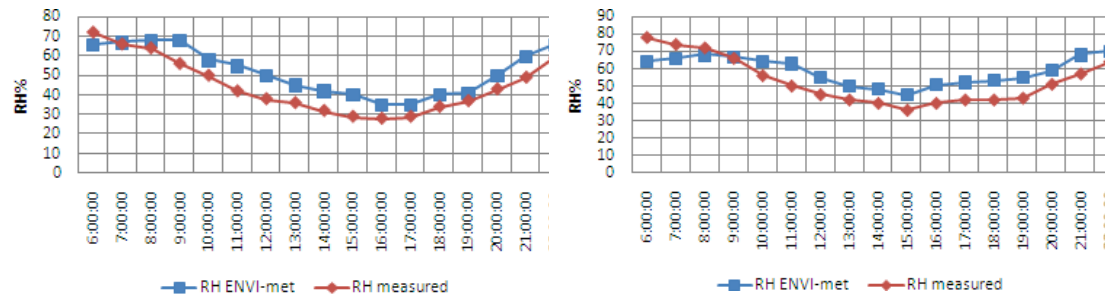


Fig.4. comparison between the Relative Humidity measured and the ENVI-met output for the renovated (left) and non-renovated (right)

Figure 5 shows the T_{mrt} calculated using the 152 mm flat black globe thermometer compared to the T_{mrt} estimated by ENVI-met. The mean radiant temperatures calculated from the globe thermometers had to be recalculated using the observed in situ values to diminish the wind factor and the diameter of the globe according to equation (1) given by ASHRAE (2001) with empirical coefficient recently refined by Thorsson et al (2007) is:

$$T_{mrt} = \left[(T_g + 273.15)^4 + \frac{1.1 \times 10^8 V_a^{0.6}}{\varepsilon_g D^{0.4}} \times (T_g - T_a) \right]^{\frac{1}{4}} - 273.15 \quad (1)$$

Where (T_g) is the globe temperature (°C), (V_a) is air velocity (ms^{-1}), (T_a) is the air temperature (°C), D [mm] is the globe diameter (= 152 mm), and (ε_{eg}) is the emissivity of the sphere (=0.95 for a black globe). The empirical derived parameter

1.1×10^8 and the wind exponent ($V_a^{0.6}$) together represent the globe's mean convection coefficient ($1.1 \times 10^8 V_a^{0.6}$).

The T_{mrt} (globe) reached their highest values in the morning until the afternoon, between 9 a.m. and 1 p.m. These were 62.7 °C and 57.2 °C respectively. on the other side, the T_{mrt} (ENVI-met) reached its highest values almost in the same time as the previous method starting from 9 a.m. with 70.51 °C reaching 65.9 °C at 1 p.m. T_{mrt} (globe) and T_{mrt} (ENVI-met) are about 33.8 and 41.6 °C respectively higher than T_a at the time of their maximum, till the sunset, when both T_{mrt} (globe) and T_{mrt} (ENVI-met) were dramatically fall down to almost reach the T_a and T_g values as the difference varies between 1 °C to 8 °C. ENVI-met is found to represent well the trends of the T_{mrt} . However, simulated values of T_{mrt} was over estimated in the morning (8 am till 10 am) and underestimated in the night time in comparison to field data.

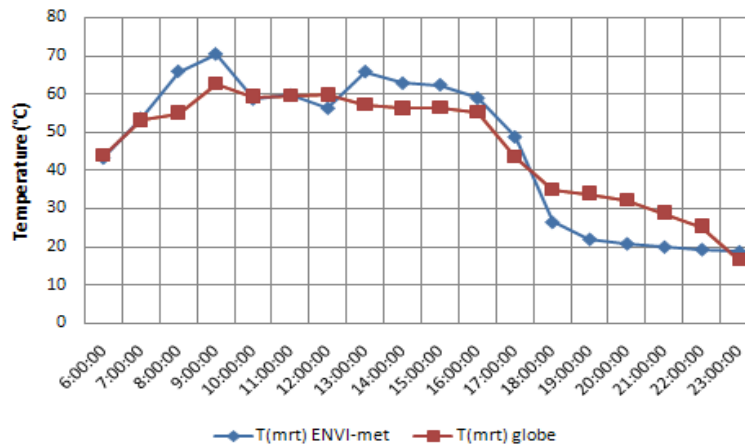


Fig.5. the mean radiant temperature T_{mrt} simulated by ENVI-met plotted against measured T_{mrt}

Although a good agreement appeared between records from the individual receptors and the averaged values for T_a , RH and T_{mrt} , yet a considerable difference found between the receptors and the average value for wind speed (V) where the discontinuity of the building fronts may influenced the wind flow at the typical low speeds recorded at street level. In addition to the data describing the above roof wind conditions were recorded by WMO Station no.623660 records at Cairo international airport which is about 15 kilometer away from the field of the study and at different height than the micro-scale for the canopy urban layer, as a result the wind speed at the canyon level is much lower.

Microclimatic map

Figure 8, 9 shows the ENVI-met models for the spatial pattern of predicted mean vote (PMV) and mean radiant temperature (daily average measured at 1.2 m height). the PMV is an outdoor thermal comfort index predicts the average thermal response (on a scale ranging from 'very hot' to 'very cold') of a group of people exposed to a set of environmental conditions. The Fanger's equation in its full form gives all human-related terms as a function of the internal heat production, together with T_a , T_{mrt} , VP, v and the clothing insulation I_{cl} . PMV is calculated by ENVI-met based on the modified Fanger heat balance equation developed by Jendritzky and Nubler, [10], for outdoor conditions, shown in the following:

$$M + W + Q^* + QH + QL + QSW + QRe + S = 0$$

Where:

M is metabolic rate.

W is mechanical power

*Q** is the radiation budget (a function of mean radiant temperature *T_{mrt}* and air velocity *v*)

QH is turbulent flux of sensible heat (a function of air temperature *T_a* and *v*).

QL is turbulent flux of latent heat (diffused water vapour)

QSW is turbulent flux of latent heat (sweat evaporation).

QRe is respiratory heat flux (sensible and latent).

S is heat stored.

The mean radiant temperature (*T_{mrt}*) is one of the most important meteorological parameter governing human energy balance and It is the key variable in evaluating thermal sensation outdoors under sunny conditions regardless of the comfort index used (e.g. Mayer and Höppe 1987, Jendritzky et al. 1990, Mayer 1993, Spagnolo and De Dear 2003). Thus it has a strong influence on thermal sensation of the pedestrians using the open public spaces. In this view the models show specific areas with high PMV and mean radiant temperature where action is needed. However, the non-renovated part of the alley revealed reductions in the whole neighbourhood pedestrian comfort records. This owed to several reasons, where the higher aspect ratio (H/W) and different street geometry causes less direct solar radiation to enter the alley and generally leads to lower *T_{mrt}* values throughout the most of the day which in turn affect the PMV. In addition to increasing the albedo of the ground surface within the non-renovated part, as it is mix between the basalt and road bare ground against the basalt and granite of the renovated one with lower albedo value. This leads to strong solar irradiation in the renovated part compared to the non-renovated one that strongly influence the *T_{mrt}* where it reached its maximum to 70.51 °C against 60.09 °C in the non-renovated one (figure 10)

Conclusion

In this paper, the application of the ENVI-met averaging tool has been validated through comparing outputs of different parameters results to receptors output. All averages records occurred between the maxima and minima of receptors outputs of each case. ENVI-met reproduces the observed data with a sufficient accuracy. Methodology composed of three steps; first, in situ measurements for each part of the alley including the main meteorological parameters and the globe temperature. Second, urban climate conditions of each case is simulated to have meteorological plots at the same certain points of the site measurements. Finally, average outdoor meteorology for each case were observed and compared with the modelling output. ENVI-met reproduces the observed data with a sufficient accuracy. The conclusions of the analysis presented herein are summarized as follows:

1. Measurements and modelling of the outdoor thermal conditions has to be seen as a tool for urban planning and mitigation of a global climate change
2. ENVI-met proved to be a reliable tool to simulate the different urban scenarios, thus, it is advisable for any planning process, or architectural intervention

- spatial distribution maps for the microclimate conditions similar to the one presented in this paper should be provided before construction.
3. The methodology described may contribute in developing guide-lines and standards for retrofitting open public spaces.

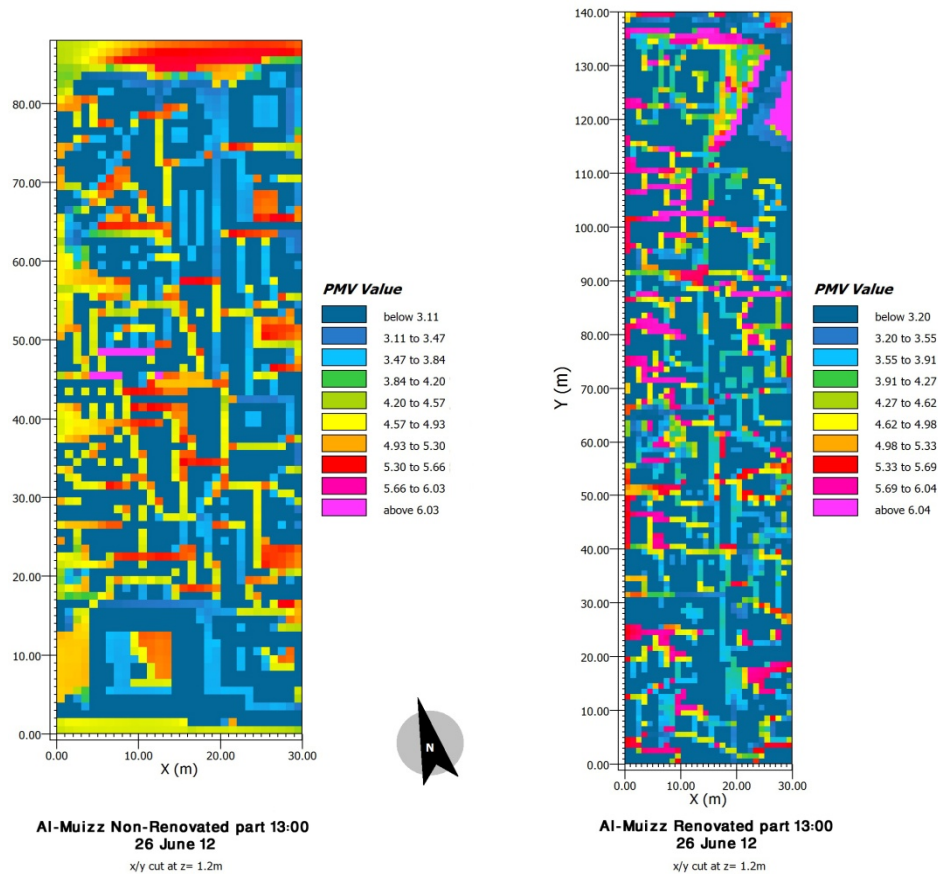


Figure 8: the spatial pattern of the Predicted Mean Vote (PMV) for 26th of June 2012 by ENVI-met

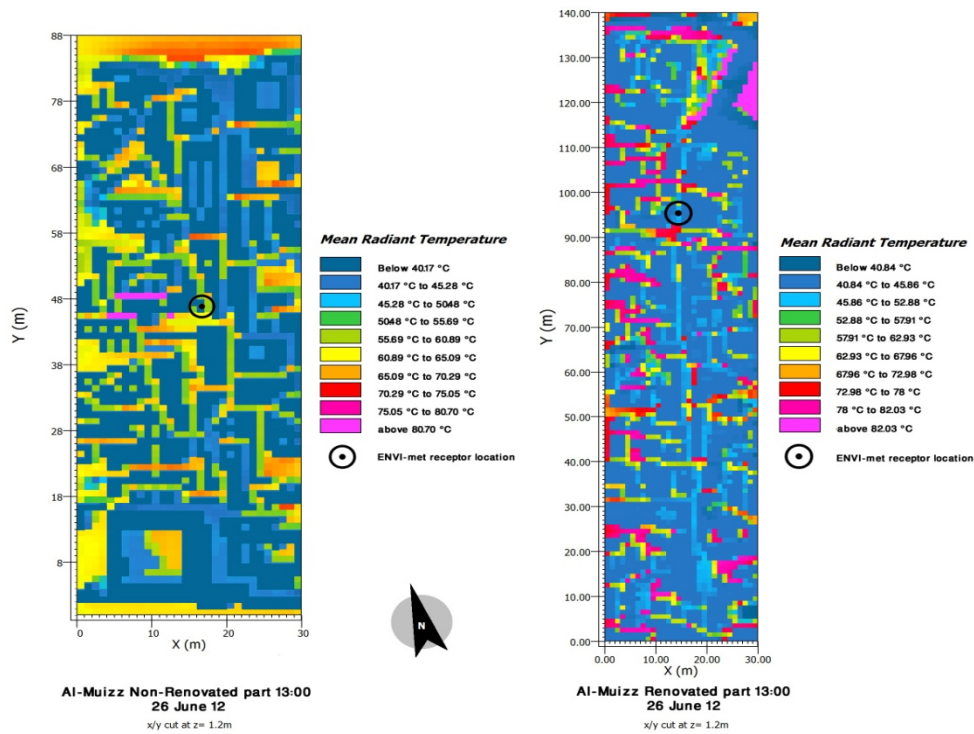


Figure 9: the spatial pattern of the Mean Radiant Temperature (Tmrt) for 26th of June 2012 by ENVI-met



Figure 10: the H/W and different urban geometry between the two parts

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Research Approach to Evaluate Post-Disaster Road Reconstruction in Indonesia

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Abstract

In the decentralized system in Indonesia, the authority and responsibility in the management of most infrastructure facilities, including road networks, have been transferred from the national government to the local governments. In the event of major disaster, road infrastructure sector often suffers a considerably large amount of damages and losses. As nearly 80% of the road networks in Indonesia are district roads, the overall quality and sustainability of the road infrastructure are significantly dependent upon the capacity of local government in road management. Nevertheless, even though literatures on road maintenance issue are abundant, literatures that link road reconstruction with the maintenance aspects in post-disaster reconstruction context are very limited. Accordingly, this paper, which is based on an on-going PhD research, highlights the main issues in post-disaster road reconstruction and subsequently discusses the research methodologies adopted for the study and illustrates how the philosophical stance perceived in the study leads to the selection of a case study as a suitable approach.

Keywords

Asset maintenance, local government, post disaster, reconstruction Road infrastructure,

Introduction

Due to the decentralisation system in Indonesia which was initiated in 1999, the fiscal and administrative systems have changed radically. In the road sector, decentralisation is translated as the distribution or transfer of authority and responsibility to manage the road infrastructure assets. Accordingly, the national government is responsible for the management of the national road networks, the provincial government is responsible for the provincial roads, and local governments are therefore responsible for the district/city roads; the latter also includes road networks at sub district and village level.

In the event of major disaster, such as the tsunami in Aceh in 2004, due to the scale of devastation, the reconstruction of district roads is often funded or co-funded either by the national government or donor agencies on behalf of the local governments. The reconstructed assets are then transferred to the respective government levels, frequently disregard to their maintenance capacity. As a result, even though most of the road networks in Aceh province have been improved after the tsunami, there are concerns whether the road reconstruction process accommodated the need to build back better the affected area and whether the assets remain sustainable according to their intended design life with regards to the

capacity of the local government in providing adequate maintenance. Within this context, this research evaluates the process of road infrastructure reconstruction in the post-disaster setting. The discussion will illustrate how the philosophical stance perceived in the study and the adopted research methodology lead to the selection of a case study as a suitable approach.

Background to the study

Many studies have shown that improvement in road transport infrastructure may provide positive impacts to the community in various ways. Crafts (2009) suggests that increased market agglomeration, productivity and labour supply resulting from reduced transport cost may generate economic development opportunities for the community. Accordingly, improvement of road networks, in particular, may provide positive impacts to the community due to better trade, communication and economic and social growth as well as increased international competitiveness (Anapolsky, 2002). It appears that the speed, flexibility and accessibility of road transport in reaching virtually all points (Beilock et al., 2002) and in connecting other transport systems (Anapolsky, 2002) remains the most important and the distinct characteristics of road networks compared with other means of transport.

From the perspective of the infrastructure sector, in a decentralized system, local government bears the greatest responsibility to plan, finance, procure and maintain their infrastructure assets. However, at the same time it also means that local governments with poor resources will have to struggle to maintain their infrastructure assets. For a road network to be sustainable over its designed life-cycle period, adequate maintenance must be allocated in accordance with its life-cycle cost (Robinson et al., 1998). It is argued that each dollar 'saved' on road maintenance may result in an increase to vehicle operating cost of between \$2 and \$3 (Heggie, 1995). Similarly, Brooks et al., (1989) suggest that if properly maintained, road construction may be expected to last twice as long and is cheaper than constructing roads to last twice as long without proper maintenance.

In the case of Aceh province in Indonesia, as shown in Table 1, the decentralisation process results in regional governments (provincial and local governments) responsible for the development and maintenance of approximately 90% of the road networks. More than 15,000 km of these networks are managed by the governments at the local level. This condition leads to a more increasing dependency of the road infrastructure towards local government road management capacities.

Table 1 - Road network condition in Aceh Province, 2004

Types of road	Good Condition		Fair Condition		Poor Condition		Total Length	
	Km	%	Km	%	Km	%	Km	%
National	127	7.4	1,052	61.3	538	31.3	1,716	9.21
Prov.	199	12.6	646	41.1	727	46.2	1,571	8.44
Districts/ Cities	2,995	19.5	9,410	61.3	2,995	19.5	15,339	82.35
Total	3,320	17.8	11,108	59.4	4,259	22.8	18,627	100

Source: Bappeda, cited in World Bank(2006)

In Indonesia, in the 30-year period from 1982 to 2011, EM-DAT (2011) recorded that the top 10 natural disasters causing the greatest losses and damages have been seismic activities (earthquake and tsunami), floods and wildfire. In total, disasters caused damage worth more than US\$21.5 billion. Five of the 10 worst natural disasters within that period have been earthquake events (including the subsequent tsunami) which accounted for almost 50% of the total losses and damage.

With regard to the Indian Ocean tsunami 2004, among other development sectors which include social, infrastructure, production, economic and governance, infrastructure suffered almost 20% of the total estimated losses and damages. Of the total amount, road infrastructure accounted more than Rp 1.7 trillion (Nugroho, 2008). The blueprint for the reconstruction of Aceh and Nias was prepared by the National Development Planning Agencies (Bappenas), based on collaborative needs assessment with different stakeholders, particularly the local government of Aceh and was issued within four months after the tsunami strike (Bappenas, 2005, Sihombing, 2009). The tsunami reconstruction blueprint also denotes that the need for the rehabilitation and reconstruction of road infrastructure in Aceh and Nias were more than Rp 6 trillion (Bappenas, 2005). More details of the losses and damages are presented in Table 2.

Table 2 - Damage and loss Aceh and Nias earthquake 2005

Sector	Damage	Loss	Total
Social sector including: housing, education, health, religion and culture	13,657	532	16,186
Infrastructure sector including: transportation, communication, energy, water and sanitation, dam	5,915	2,239	8,154
Production sector including: agribusiness, fishery, industry and trade	3,273	7,721	8,154
Cross-sector including: environment, Government Administration, banking and Finance	2,346	3,718	6,064
Total (billions of Rp*)	27,191	14,210	41,401

*) US\$ 1 ~ Rp 10,000 Source: (Bappenas, 2005)

In addition to delays and cost overruns as the common problems found in road projects (Adnan et al., 2009, Ahmed et al., 2002), reconstruction of road infrastructure in post-disaster reconstruction setting may have other issues. In the reconstruction of Aceh, the number of pledges made to Aceh exceeded the required amount to restore the regions to their pre-disaster condition (Subekti, 2009). As a result, a 'build back better' scenario in the rehabilitation and reconstruction of the affected region beyond its original condition was possible to implement.

However, from the road sector perspective, building more road than affected also presents local governments and road management agencies with extra and long-term financial and technical burdens. Additional resources will be required to maintain and ensure the sustainability of the newly constructed roads throughout their designed life-cycle. Accordingly, a strategy to adequately incorporate local government capacity into the post-disaster road reconstruction plan is considered to be the key to ensuring the sustainability of road reconstruction assets.

The above discussion has provided an overview of the decentralisation issue in Indonesia as well as the impact of decentralisation towards road management at the local level. Accordingly, the following section will therefore discuss the research methodology used to evaluate the process of post-disaster road reconstruction in Indonesia.

Research Methodology

Prior to conducting any research, it is essential that the methodology of the research is prepared. Research methodology is defined as the overall approach to be used for the research process, from the theoretical underpinning to the collection and analysis of the data (Collis and Hussey, 2009). Accordingly, the remainder of this section will elaborate the research methodology of this study following the steps of the research onion model (Saunders et al., 2009), starting with the research philosophy as the first layer.

Research Philosophy

Saunders et al., (2009) express research philosophy as an over-arching term that relates to the development of knowledge and the nature of that knowledge. Most literature classifies research philosophy into three main perspectives, namely ontology, epistemology and axiology. Accordingly, the following paragraphs will provide a brief summary of each perspective and later describe the philosophical stance of this study.

Ontology

Ontology concerns the nature of reality and assumptions about the way in which the world works (Saunders et al., 2009). There are two aspects of the ontological position; objectivism and subjectivism. At one end of the spectrum, objectivism assumes that social entities exist in reality external to the social actor concerned with their existence. At the other end of the spectrum, the term subjectivism holds that social phenomena are created from the perceptions and consequent actions of those social actors concerned with their existence and is often associated with social constructionism that views reality as being ‘socially constructed’ by different social actors (Saunders et al., 2009).

Epistemology

Epistemology concerns what is acceptable knowledge in a particular field of study (Saunders et al., 2009). In their book, Easterby-Smith et al., (2002) define epistemology as a general set of assumptions about the best ways of inquiring into the nature of the world. There are different names assigned to philosophical stances within epistemology but they generally have similar meanings. Saunders et al., (2009) distinguishes epistemological stances into positivism and interpretivism while Remenyi (1998) categorises them as positivism and phenomenology.

According to Saunders, a research using a positivism philosophy is likely to represent a natural scientific approach where only observable phenomena can lead to credible data. In a similar fashion, Remenyi (1998) adds that working within a positivism philosophy implies that the researcher is working with an observable social reality and that the end product of such research can be the derivation of laws or law-like generalisation similar to those produced by the physical and natural scientist.

The interpretivism approach recognizes that differences that exist between humans as social actors, and encourages the researcher to understand such differences (Saunders et al., 2009). The challenge for a researcher adopting the interpretivism approach would be to enter the social world of the research subjects and understand their world from their point of view (Saunders et al., 2009).

Axiology

The third continuum in research philosophy is axiology. Axiology is a branch of philosophy that studies judgement about values (Saunders et al., 2009). These value judgments may lead to the drawing of a conclusion which may be different from those drawn by the researcher with other values. The main emphasis in this philosophical branch is whether research assumptions are made in a value-laden or value-free environment (Collis and Hussey, 2009).

Philosophical stance of this study

Within the context of the research philosophy, the aim of this research is to evaluate the process of road reconstruction in a post-disaster reconstruction context in Aceh, Indonesia. As this process involves different stakeholders and the fact that their 'subjective' perceptions and decisions collectively 'socially construct' what is seen as the road reconstruction 'phenomena', the ontological stance of this research falls into the subjectivism continuum. Additionally, this research includes special emphasis in the involvement and role of local governments in the road reconstruction process. Different perceptions and experiences of various stakeholders involved throughout the reconstruction process will be analysed. Among others, their interpretation of the phenomena found during the road reconstruction process will vary according to the roles, responsibility, capacity and level of experience of each stakeholder. Accordingly, this research recognizes and values such differences and will therefore utilize in-depth semi-structured interviews with a number of stakeholders and experts to understand their different perceptions. From that point of view, the epistemological stance adopted by this research lies in the interpretivism approach.

In addition, the data collection process includes interviews with different sources. The researcher believes that personal interaction with the interviewees is of high importance in order to obtain a good insight into the interviewees' perceptions and to understand the context of the phenomena being discussed. Hence, from axiological stance, this research will be value-laden in nature.

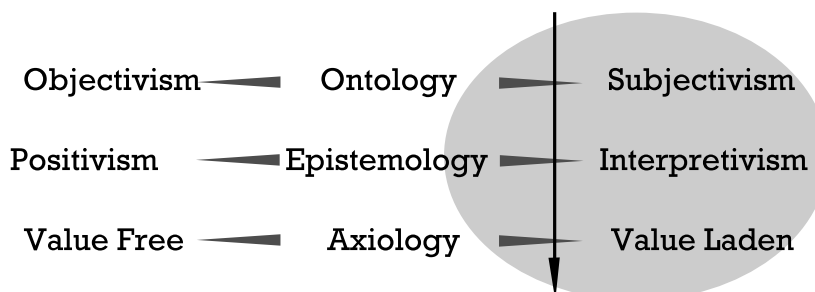


Figure 1– The Research Philosophy of This Study

The above figure summarizes the philosophical stance of this study. Furthermore, following Saunders research onion layers, the next section will discuss the

appropriate research approach of this study

1.1 Research Approach

According to Saunders et al., (2009), the research approach relates to theory development. There are two types of approaches to research, deductive and inductive. In the deductive approach, the researcher develops theory and hypothesis (or hypotheses), expresses the hypotheses in operational terms to explain the relationship between variables and tests these hypotheses prior to examining the specific outcomes and, if necessary, modifies the theory according to the findings (Robson, 2002 cited in Saunders et al., 2009).

In the inductive approach, in contrast, no theory is developed prior to data collection. Instead of creating a cause and effect link independently as in the deductive approach, the research using the inductive approach believes that an insight into the way in which humans interpret and perceive their social world is critical and is particularly concerned with the context in which such events take place (Saunders et al., 2009).

This research is mainly a combination of exploratory and explanatory. The general objectives of this research are to find out what happened in the post-disaster road reconstruction process in Aceh as well as to understand the reason behind the phenomena. Apart from the understanding gained from literature and document reviews, no theories and propositions or hypotheses are made for testing. Instead, data will be collected through interviews and document analysis from which a conclusion will be made at a later stage. Accordingly, from that perspective, this research requires an inductive approach rather than deductive.

The next layer of the research onion is the research strategy. Therefore, the various strategies suitable for this study are discussed briefly in the following section.

1.2 Research Strategy

In conducting research, there are a number of strategies or approaches that can be adopted. The choice of an appropriate research strategy for a study is based on the research questions and objectives (Avison et al., 1999, Saunders et al., 2009), the extent of existing knowledge, the amount of time and other resources available and the philosophical underpinnings (Saunders et al., 2009).

Yin (2003) divides research strategies into experiment, survey, archival analysis, history and case study. Each research strategy has its own advantages and disadvantages. However, a common misconception is that the various research strategies should be arrayed hierarchically and that certain strategy will only fit certain phase of the research (Yin, 2003). In fact, each strategy can be used for all three research purposes; exploratory, descriptive or explanatory. Instead of distinguishing the strategies hierarchically, Yin (2003) argues that there are three other conditions for identifying research strategy; the type of research question posed; the extent of control an investigator has over actual behavioural events and the degree of focus on contemporary as opposed to historical events. The following table summarises characteristics of each strategy.

Table 3 – Relevant Situations for Different Research Strategies

Strategy	Form of research questions	Requires control of behavioural events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many/much	No	Yes
Archival analysis	Who, what, where, how many/much	No	Yes/No
History	How, why	No	No
Case study	How, why	No	Yes

Source: COSMOS, cited in Yin (2003)

The first condition for identifying a research strategy concerns the type of research questions, which are commonly categorized into ‘who’, ‘what’, ‘where’, ‘how’, and ‘why’ type of questions (Yin, 2003).

The purpose of this study is partly exploratory, which is, to find out and understand what happened in the post-disaster road reconstruction in Aceh. The remaining questions of this study include ‘why’ type questions, as the second purpose of this study is also explanatory. This means that in addition to finding out what actually happened in the road reconstruction process in Aceh through addressing some ‘how’ type questions, this study is also aiming at understanding ‘why’ such phenomena occurred and establishing causal-links between the observed phenomena.

The second conditions that Yin emphasises is related to the ability and requirement to control behavioural events (Yin, 2003). As summarised in Table 3, this condition is obviously required for an experimental method. The experimental method owes much to natural science where the purpose is to study causal links through observing the effect of interventions of one independent variable towards another dependent variable (Hakim, 2000 cited in Saunders et al., 2009) directly, precisely and systematically (Yin, 2003). Since this study does not have control over the behavioural events of the study objects, conducting an experiment research is not possible for this study. At this point, the remaining possible options for this study are history and case study method.

To identify the more appropriate strategy between the remaining two options, the third condition is applicable. This condition is related to the degree of focus on contemporary as opposed to historical events. Whilst the historical method focuses on past events where documents and cultural and physical artefacts are used as the main sources of evidence, a case study has two additional techniques not usually included in the historical method; direct observation and interviews (Yin, 2003). Even though road reconstruction in Aceh is mostly completed, it can be considered as contemporary since the issue is still relevant to present conditions and many of the stakeholders and experts involved in the process are still available to provide input for this study through interviews. Accordingly, based on the aforementioned justification, the case study method is considered to be the most appropriate for this

research and thus is adopted.

Based on the above reasoning and justification, the case study strategy is considered as the most appropriate strategy for answering the research questions of this study. However, as Saunders et al., (2009) emphasises, this research strategy should not be thought of as being mutually exclusive and combinations or use of more than one strategy in one research is quite possible. The next section will explain the next layer of Saunders research onion that is concerned with the research choices.

1.3 Research Choices

Research choice is concerned with whether qualitative or quantitative data, or both, is used for a study. Saunders et al., (2009) points out that individual quantitative and qualitative techniques and procedures do not exist in isolation. When quantitative and qualitative data collection and analysis procedures are used in parallel or sequential time in a study, the study is referred to as using a mixed-method research. Additionally, if the study combines the qualitative and quantitative techniques and procedures, the study is referred to as using a mixed-model research. This study will organize more than one data collection technique and analysis procedure. Also, to a certain degree, the result of the qualitative data (such as interviews), will be analysed quantitatively in forms of word counts, frequency of occurrence and duration. On the other hand, the results of questionnaire may also be analyzed qualitatively. Hence, from this perspective, this study falls into mixed-model type of research.

The next section will ‘peel off’ the next layer of the research onion, which is the time horizon of the study.

1.4 Time Horizon

Furthermore, the main aim of the study is ‘to evaluate the process of post-disaster road infrastructure reconstruction within the context of the role of the local government and its capacity in managing the road infrastructure assets. Here, the study is looking at a ‘snapshot’ of time, which is the post-disaster reconstruction period; with specific attention given to the time when the road reconstruction process took place and is not trying to compare or observe changes in, or development of, any particular phenomenon being studied over a period of time. Hence, from a time horizon perspective, this research can be considered as a cross-sectional study.

The next section will provide a brief discussion on the research techniques adopted in this study, which will include data collection and data analysis techniques.

1.5 Research Techniques

Research techniques relate to data collection and their analysis procedures. Walliman (2006) defines data as the raw materials of research that can be interpreted and refined into conclusions. Moreover, he argues that even though data can be collected from virtually everywhere, it needs a plan of action that identifies and uses the most effective and appropriate methods of data collection. Accordingly, this section will elaborate on data collection techniques and analysis procedures of this study.

Data collection techniques

One of the main advantages of case study research is the opportunity to employ various data collection techniques. According to Yin (2003), the sources of evidence for case study research may be obtained from six sources; documents, archival records, interviews, direct observation, participant observation and physical artefact. Among the many sources of evidence that can be employed for a case study, this research will primarily collect data through documents, interviews and questionnaires.

The post-disaster road-reconstruction projects in Aceh involved an extensive number of government bodies, NGOs, media, donors and international aid agencies. Accordingly, they have also produced a number of progress reports, lessons learned reports and news articles, most of which are available for public access. These documents will be one of the main sources of evidence for this study. Also, information obtained from these documents, including results from literature reviews, will be used to develop the list of questions used for the interviews and questionnaires.

As stipulated earlier, in addition to answering the 'how' type of questions, this study is also trying to answer a number of 'why' questions. This requires profound understanding and justification over, for example, certain decision-making procedures and solutions to particular issues. Such understanding is expected to be achieved by doing semi-structured interviews with a number of stakeholders and experts relevant to the road-reconstruction context.

Questionnaires will also be used for this study as a method of triangulating the data. As there are different definitions of questionnaires, it is worth stressing that the questionnaire intended for this study is in accordance with deVaus' (2002) definition of a questionnaire, as cited by Saunders et al., (2009), which 'includes all techniques of data collection in which each person is asked to respond to the same set of questions in a predetermined order'. Thus, in line with the definition, a set of standardised questions will be developed and distributed to a wide range of stakeholders and experts relevant to the study objectives. The type of the questionnaire will be a self-administered one where the questionnaires are completed by the respondents through either a paper-based or electronic-based interface.

Data analysis

Data analysis procedures consist of examining, categorizing, tabulating, testing or otherwise recombining both quantitative and qualitative evidence to address the initial propositions of a study (Yin, 2003). Qualitative data refers to all non-numeric data or data that have not been quantified while quantitative data refers to all numeric data (Saunders et al., 2009). Developing a general strategy for data analysis is essential as it may reduce potential analytic difficulties (Yin, 2003).

Prior to making an analysis, data collected from non-written evidence; such as interviews and direct observations will need to be transcribed into written accounts. For the analysis, Computer-Assisted Qualitative Data Analysis Software (CASDAQ) is used. In this case, the software used will be NVivo version 9. An indication of tone in which comments were made and other non-verbal indications seen from the interview process will also be included as additional notes in the respective transcription. According to Saunders et al., (2009), using such software

systematically may help establish continuity and increase both transparency and methodological rigour.

Furthermore, the data coding process carried out using NVivo may lead to quantification of the qualitative data through measuring the frequency of occurrences and their duration. On the other hand, the results of the quantitative data collected from questionnaires may also be analysed qualitatively and expressed in words rather than numbers. Thus, this emphasises the justification for considering this study as adopting a mixed-model research as explained in section 1.3.

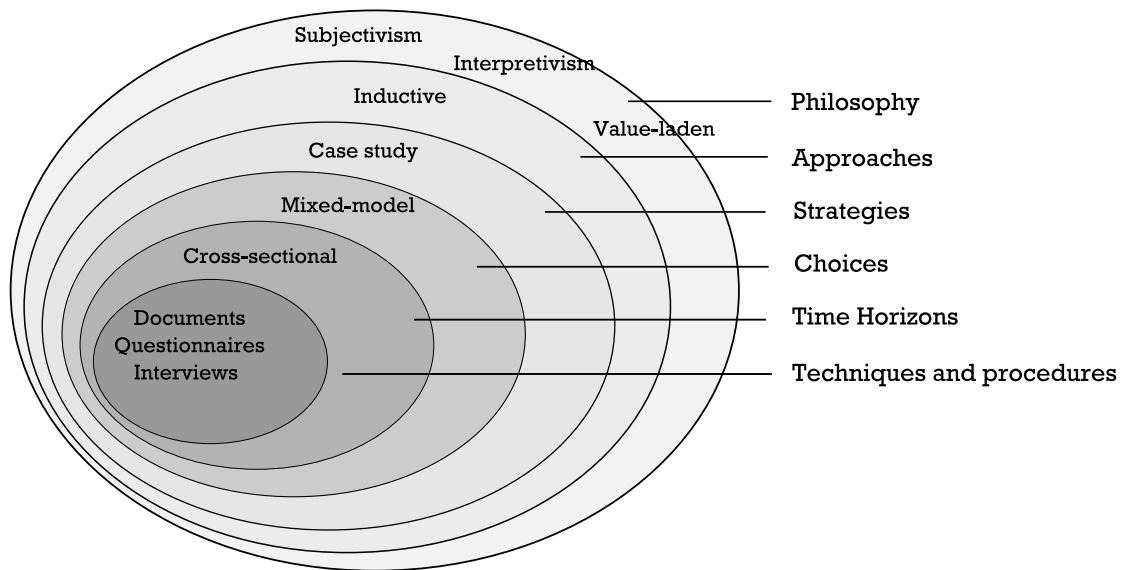


Figure2. Methodology of This Research (Adopted from *Saunders' Research Onion*)

Finally, the above Figure 2 summarises the research methodology adopted by this study; following the research onion model of Saunders et al., (2009)

Since the development of the research methodology, the study has progressed with an extended literature review process and the collection of secondary data in form of district road conditions and district annual budget allocation and expenditure on the road sector. Based on the input from literature review and secondary data, the study has developed the data collection protocol, which is required for the collection of primary data in form of semi-structured interviews with a number of stakeholders involved in the reconstruction of road infrastructure in Aceh.

Conclusion

It has been generally accepted that even though disasters may cause great suffering to people and cause significant setbacks in the development, disasters may also offer opportunities for physical, social, political, and environmental development that may not have been available previously. Accordingly, whilst the extent is dependent on the availability of funds, the Build Back Better principle is generally adopted in a post-disaster reconstruction.

Even though such opportunity may help accelerate the overall post-disaster recovery, there is a concern whether the local governments are capable of

maintaining the road assets in the long run, particularly due to the poor record of road management in Indonesia.

In regard to the road management, the rapid decentralization process put the responsibility for the management of nearly 80% of the total road networks in Indonesia on the local governments' hands. However, the poor capacities of the local governments in the road management have resulted in less than 25% of the district roads are in good condition.

From the literature review process, it has been realised that there is a gap in the knowledge concerning the reconstruction of road infrastructure in the post-disaster context, particularly that which links road reconstruction with local government maintenance capacity. Consequently, this research argues that a strategy to adequately incorporate local government capacity into the post-disaster road reconstruction plan is the key to ensuring the sustainability of road reconstruction outcomes.

Within this context, the main purpose of this paper is to discuss and justify the research methodology being proposed. Accordingly, the study considers that for the case study research, a qualitative study with a semi-structured interview is the most appropriate approach to evaluating the post-disaster road reconstruction in Indonesia.

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Use of CFD Simulation in Urban Design for Outdoor Thermal Comfort in Hot and Dry Climates: A Review

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Abstract

Pedestrian thermal comfort in outdoor environments depends mainly on environmental parameters, urban physical configurations, and socio-behavioural factors. Due to rapid urbanisation and the density of urban construction, the characteristics of outdoor microclimate have been influenced, leading to pedestrian dissatisfaction with the thermal environment in many cities. This problem has posed many challenges to urban designers and other researchers in finding suitable ways to mitigate the heat stress of thermal environments in outdoor urban spaces. The purpose of this current research seeks to review the appropriate methods that may be used to increase the thermal comfort conditions in outdoor pedestrian spaces. This paper also reviews the use of computational fluid dynamics (CFD) to simulate outdoor wind flow conditions that affect pedestrian thermal comfort in urban design as a tool for the simulation of outdoor thermal comfort factors. Finally, it highlights a number of advantages and challenges in the application of CFD.

Keywords

CFD; Outdoor Pedestrian Space; Thermal Comfort; Microclimate; Urban Design

Introduction

The outdoor pedestrian thermal sensation conditions depend mainly on environmental parameters (i.e. air and radiant temperatures, solar radiation, relative humidity and air velocity), urban physical configuration (i.e. urban fabric, buildings height and arrangement, vegetation, water features, ground surface treatment and building surface materials), and socio-behavioural factors (i.e. expectation, clothing rate and activity level). However, in the last few decades, due to the rapid urbanisation and the dense construction in urban areas, the characteristics of outdoor microclimate have been influenced, leading to pedestrian dissatisfaction with the thermal environment in many cities. This problem pose many challenges to urban designers and other researchers in finding suitable ways to mitigate the heat stress of thermal environments in outdoor urban spaces. Therefore, the purpose of this current research seeks to find out appropriate methods to increase the thermal comfort in the spaces between buildings; such as the use of water features, large areas of vegetation, and use of reflective materials. It highlights air temperature, radiant temperature, air velocity, humidity, activity level and clothing as the main interaction factors in human thermal comfort level. This paper also reviews the potential and limitations of using CFD in urban design as a tool for underpinning our understanding of outdoor thermal comfort parameters.

Thermal Comfort Interaction Factors

The quality of life within a city environment is strongly influenced by the quality of outdoor spaces and the level of human comfort offered by these spaces (Makaremi et al., 2012). Thermal comfort in outdoor areas can be affected by the individual buildings in that specific location, the urban morphology at a scale of neighbourhood, the urban heat island (UHI) effect at a scale of city, the effect of topography at a scale of regional area and the effects of climate and climate change at the global scale (Moonen et al., 2012). Gaitani et al. (2007) argue that the human thermal comfort condition is determined by six main interaction factors, where four are physical parameters and two are personals that should be considered for the thermal comfort condition calculations, which are:

1. Ambient air temperature: influences the convective mode of heat transfer as well as the exchange of dry and humid air;
2. Velocity of the air movement: significantly influences the heat convection and loss percentage of evaporation from our body;
3. Relative humidity: influences human thermal sensation when there is high a percentage of moisture in the air, especially when increased sweating occurs;
4. Mean radiant temperature: influences the radiation mode of heat transfer.
5. Activity level: influences the human metabolic rate that is the amount of energy produced per unit of time.
6. Clothing ratio: influences the thermal and hydric exchanges between the human body and environment by either resisting the exchange or assisting.

In order to measure human thermal comfort (i.e. the perception satisfaction with the thermal environment) it is necessary to establish at an early stage a comfort index, which basically demonstrates the comfort sensation of a person in a given condition (Moonen et al., 2012). Thermal comfort can be defined using a number of indices, including the Extended Predicted Mean Vote (PMV), Standard Effective Temperature (SET*), Physiological Equivalent Temperature (PET), Outdoor Wet-Bulb Globe Temperature (WBGT_{out}), etc. PMV was originally developed for indoor environments and has been extended to calculate the outdoor thermal comfort for a given level of activity and clothing ratio using air temperature and humidity, with air speed and mean radiant temperature. SET* on the other hand, predicts the outdoor thermal comfort based on the air temperature of a reference environment in which a person has the same mean skin temperature and skin wetness as in a real situation. Whereas, PET is defined “as the air temperature of a reference environment in which the heat budget of the human body is balanced with the same core and skin temperature as under the complex outdoor conditions to be assessed” (Moonen et al., 2012:6). Finally, the WBGT_{out}, which can be used to measure human heat stress in outdoor environments, is calculated by dry bulb temperature, wet bulb temperature, and black globe temperature (Auliciems and Szokolay, 2007).

The behaviour of outdoor urban environments is significantly different to natural environments, because the artificial materials used to create that environment affect the absorption of short and long wave radiation (Mirzaei and Haghighat, 2010). The urban environment also affects the transpiration, the release of anthropogenic heat, and blocks prevalent wind, all of which can affect the microclimate of the urban environment. According to Ahmed-Ouameur and Potvin (2007), the variation of texture in an urban space can modify micro-climatic parameters such as humidity, air temperature, solar radiation, wind direction and speed, which in turn affect

pedestrian comfort. Thermal comfort can be affected by urban morphology such as the geographical location of the area and by the urban form, including the orientation, volume, dimensions, and proportions of the urban landscape (Lin et al., 2010). The types of materials used in the horizontal and vertical limits as well as the type and extent of vegetation, will significantly influence the thermal quality of the outdoor microclimate. Research proves that the air temperature in densely built areas is higher than in other areas (Moonen et al., 2012). This increase in heat is attributed to the fact that short and long-wave radiation is trapped within the building, heat is stored in the building fabric, and there is a release of anthropogenic heat from energy used in air-conditioning or heating the building.

Outdoor Adaptive Thermal Comfort Methods

The design of adaptive thermal comfort methods should take account of the local population, their physiological adaptation to thermal environments, and their expectations. Lin (2009) cites studies, which found that people living in hot and humid regions have greater tolerance for high temperatures than those residing in temperate regions. This implies that the design of outdoor urban space since occupant perceptions and preferences for thermal environments vary with an individual's physiological adaptation to a climate, as well as psychological expectations of environmental performance (Lin, 2009).

In designing for thermal comfort in an outdoor urban area, a designer must consider the trade-off between various physical interventions to buildings and urban space that the shelter provided and the disruption to wind patterns that may promote thermal comfort (Lin, 2009). The aim of these facilities is to give the urban user a degree of choice over their use of outdoor space. A study by Nikolopoulou and Steemers (2003) found that people want to have control of their space, for example people want to have the choice in deciding whether they sit in the sun or the shade.

Various methods can be used to improve the thermal comfort of the urban space users, including creating shelters using trees, vegetation and natural landscaping, or by constructing artificial shelters. These shelters can block direct short-wave radiation flux and reduce temperatures of the urban surfaces. The use of the space can be maximised in all thermal environments, if there are benches to avail of the warm sunshine in winter or spring (Lin, 2009). Moonen et al., (2012) suggest that other mitigation measures include ground-level ponds and roof ponds. Mirzaei and Haghighat (2010) add that the most effective mitigation measures to reduce thermal discomfort and UHI include using reflective materials in a city, increasing the level of soft landscaping, creating ponds within urban areas, and reducing released of anthropogenic heat by appropriate design of canopies and buildings. Attia and Duchhart (2011) points out that hard landscaping can be used to offer protection from the elements, providing shade from the sun and shelter from the wind.

Brown (2010) indicates that the materials and the colour of those materials used in an outdoor urban environment can promote thermal comfort. For example, light coloured materials reflect solar radiation, which means that the surface will remain cooler than dark surfaces. However, the reflected solar radiation will be absorbed by another surface within the landscape. In contrast, dark coloured materials will absorb radiated heat which means that a dark coloured surface will heat up faster than a light coloured surface, with minimal, if any reflected radiated heat. Konstantina (2011) suggests that the type of materials used in an urban environment

can affect not only the thermal comfort of the urban dwellers but their perception of thermal comfort. Konstantina (2011) points out that if there is a high use of albedo (i.e. the fraction of solar radiation reflected from a surface) materials in the urban environment, then there will be small variations in relative temperature in that area. This can be avoided by creating urban space with different materials, for example using albedo materials mixed with areas of grass or water features. This mix creates variations in temperature and also creates a visual diversion for users of that space. Attia and Duchhart (2011) argue that the type of urban design will depend on the climatic conditions of the particular site. For example in hot and arid regions, where there is a great variation in diurnal temperatures, trees can be used in urban areas to retain warm air at night. The level of heat retained depends on the type of trees and the foliage density, the size and shape of the trees as well as their location. Deciduous trees have dense foliage and can therefore be used to provide solar protection and retention of heat. Water features can provide a natural cooling mechanism to reduce ambient temperatures in an urban area through evaporation. According to Attia and Duchhart (2011) the surface temperature of the water is affected by heat transfer and evaporation, such that water is normally warmer in winter and cooler in summer, with day time temperatures lower than night time temperatures. This means that bodies of water can moderate extreme temperature variations.

However, there are a number of ways in which the thermal comfort of outdoor space can be assessed in order to facilitate the design of suitable mitigation measures. Mirzaei and Haghighat (2010) imply that one of the difficulties in analysing specific urban microclimates and designing suitable mitigation measures is that this microclimate is the result of a multitude of micro-scale processes such as human metabolism and middle-scale interactions including wind, temperature, humidity and other atmospheric forces. In analysing this type of climate, it is not always possible to integrate all the contributing factors accurately and therefore a designer must make certain assumptions and simplifications in the analysis process. These simplifications can make the results less effective. There are different methods used to analyse the thermal environment and to enable the design of adaptive thermal comfort, including simulation methods, e.g. Computational Fluid Dynamics (CFD) (Mirzaei and Haghighat, 2010).

Use of CFD Simulation in Microclimate Studies

Computational fluid dynamics (CFD) is a simulation modelling technique that was developed as a mechanical engineering design tool. This technique has developed for analysis of air movement in and around buildings, investigating the pedestrian wind environment, the effects of wind driven rain and the impact of vegetation on urban microclimate (Erell et al., 2011). CFD can be used to analyse ventilation and heat concentration patterns at the urban design stage to facilitate the design and development of outdoor spaces that offer the urban occupant a comfortable usable environment (Chung and Choo, 2011). It is used for both the indoor and outdoor environmental studies. When designing an indoor environment, designers can use CFD to analyse and develop efficient ventilation and ventilation management systems (Somaratne et al., 2005). In outdoor urban design, CFD simulation can be applied to assess the effects of heat gain from the building geometry, building materials and other external heat sources such as air-conditioning units (Priyadarsini et al., 2008).

Thermal comfort is a complicated interaction of physical and physiological factors and these complex interactions are difficult to model and to analyse. Ahmed-Ouameur and Potvin (2007) carried out a study of the effects of different morphological conditions on pedestrian thermal comfort. The study divided the urban fabric scale into four indicators, i.e. building density, vegetal density, urban roughness, and porosity. The researchers concluded that these factors could affect the ambient temperature, radiant temperature and relative humidity, as well as the wind movement and light intensity in an urban area. Auliciems and Szokolay (2007) point out that thermal comfort is also influenced by thermal perception, personal preference, and satisfaction. According to Lin et al. (2010) the outdoor thermal environment is affected by anthropogenic heat, evaporation shading of landscaping and buildings, as well as the ground covering. Chung and Choo (2011) state that different urban typologies affect the wind flow through a city or urban environment. In essence, as the city becomes more compact with higher building height to width ratios, the UHI will increase. In addition wind patterns in and around an urban landscape can affect the thermal comfort of urban dwellers. A study by Cheng et al., (2007) established the importance of wind in response to thermal comfort and concluded that thermal discomfort increased when wind was suppressed. The study also concluded that an increase of between 0.3-1 m/s of wind speed could reduce ambient temperature by 2°C, which could help ensure thermal comfort for outdoor space users (Cheng et al., 2007).

Given the complexity of these factors, Chung and Choo (2011:35) point out that CFD can be used to understand the airflow in an urban environment. CFD simulations used to analyse heat gain and to generate cross-ventilation and improve thermal comfort. According to Mirzaei and Haghighat (2010), the benefit of CFD is that it simultaneously solves all the governing equations of fluid inside the urban areas, including conservation of mass, potential temperature, momentum, and water vapour. This means that it is possible to obtain very accurate information regarding UHI distribution within and above building canopies with CFD than with other simulation techniques including energy-balancing models.

Advantages and Drawbacks of CFD Tool

As the world becomes increasingly populated, there will be an increasing need for dense urban developments, potentially increasing the number of high-rise buildings in the urban landscape. This type of development can trap radiated heat, air pollutants and create thermally uncomfortable outdoor environments for urban occupants and in doing so can adversely affect the identity of the microclimate of outdoor urban space (Chung and Choo, 2011). According to Mirzaei and Haghighat (2010) summertime UHI can decrease the outdoor air quality, increase the energy demand of a city. It can also intensify pollutants in urban atmospheres, alter local wind patterns, increase humidity with the ambient temperatures, and affect the rate of precipitation. The advantage of the CFD technique is that it can be used to analyse most of these factors, including heat radiation patterns, wind direction, and speed. Numerical modelling with CFD can investigate the convective heat transfer coefficient (CHTC) and convective mass transfer coefficient (CMTC) for exterior surfaces of buildings to evaluate its effect on the environment (Blocken, 2009). Recent studies show that CFD can also simulate air pollutant concentration distributions around buildings (e.g. Tominaga and Stathopoulos, 2009) and in urban street canyons (e.g. Neofytou et al., 2008). CFD is therefore useful in analysing the

microclimate of dense urban space. The data developed in CFD simulation modelling can be used by designers to improve the comfort levels of the urban thermal microclimate (Chung and Choo, 2011).

By improving the design process, it could be argued that CFD also enables a designer to maximise the use of outdoor space, as urban dwellers are more likely to stay in air-conditioned buildings if the outdoor space is too hot, too humid, or polluted. The indirect advantage therefore of CFD is that in making outdoor space more attractive, there may be potentially less energy used on air conditioning, which is beneficial to the environment in terms of decreasing artificial heat sources. If the simulation model is implemented at the design stage of a project this can ensure that, the development of design can be optimised for thermal comfort (Chung and Choo, 2011).

Other advantages of CFD in urban design studies compared to observational techniques, field experiments or wind-tunnel experiments include the fact that in CFD there are virtually no restrictions on the geometry of the computational model, whereas in using alternative methods such as a wind tunnel, the geometry has to be scaled down. The CFD allows a large degree of freedom with respect to boundary conditions modelled. CFD enables the designer to obtain a very high spatial flow-field resolution in specific areas of interest by using spatial discretisation. This high resolution can be obtained at every location in the flow field, whereas when using field experiments or wind tunnels, there is limited spatial resolution and access for complex configurations. A further advantage of this technique is that fluid flow, active and passive scalars such as heat, moisture, and pollutants can be solved at the same time. This is possible to a degree in field experiments but not feasible in wind tunnels due to the small scale of the process. Technically building geometries and scalars such as pollutants and snow can be measured at their actual scale in CFD. The high spatial resolution in the CFD makes it relatively easy to obtain data such as heat flows from urban surfaces and flow rates through building openings (Moonen et al., 2012).

On the other hand, one of the CFD challenges is that it is difficult to solve problems of turbulence and the transfer of convective heat in the urban environment. CFD models are process-based tools, which therefore require high data inputs and a great level of complexity, as well as high computational costs that can make it difficult to quantitatively evaluate the uncertainty of the predictions (Robson et al., 2008). According to Blocken et al. (2009:489) “accurate CFD modelling of convective heat and mass transfer requires accurate and detailed modelling of each part of the boundary layer.” In order to obtain accurate results, each boundary layer must be modelled in detail, which requires complex high-resolution grids, and makes the process complicated and difficult (Blocken et al., 2009). This will cost time for both the analysts to create a model and for the computer to calculate the equations (ASHRAE, 2009). Erell et al. (2011) agree stating that it is difficult to model the boundary conditions in an urban area with a high degree of accuracy to obtain useful results from CFD. According to Mirzaei and Haghighat (2010), the main problem with CFD is that the atmospheric interactions of a city are complicated and their analysis requires a vast number of nodes to simulate a city. Another problem is that it is difficult to match the temporal and spatial resolution of the interactions within a city. For example, the different scales of atmospheric turbulence and canopy-scale turbulence. These factors must be simplified and modelled separately in the CFD process, which affects the accuracy of the results. Erell et al. (2011) add

that the calculations obtained from CFD are limited to short periods of time and the methodology cannot be applied to problems requiring time scales longer than a few days. Another difficulty with CFD is that the package is not available in most professional practices. According to Chung and Choo (2011:36-37), even when the package is available there can be an operating system compatibility problem with some users running the system on Linux and UNIX platforms, while others use Windows or Macintosh platform, which is also typically used for Computer Aided Architectural Design systems. This incompatibility makes it difficult to integrate work and create continuity in the design process.

Conclusion

In conclusion, this paper has highlighted the six main interaction factors in thermal comfort on pedestrian level, which have been grouped into environmental factors, i.e. air temperature, radiant temperature, relative humidity and air velocity, and personal factors, i.e. activity level and clothing ratio. These interaction factors can be controlled by appropriate design using thermal comfort adaptive methods. The suggested methods in this paper were the use of water features, large vegetated areas, the use of high reflective surface materials on buildings and ground covers, and the use of shading elements. Furthermore, it has demonstrated the use of CFD simulation in this field of urban space design for the enhancement of outdoor pedestrian thermal comfort conditions. Although CFD technique has both advantages and disadvantages, it is suggested that it has huge potential in the assessment of thermal environment and wind comfort.

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Risk Assessment on Community-Based Post-Disaster Housing Reconstruction Project

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Abstract

Risk management method has been acknowledged to be an important factor to achieve the project objectives in the construction industry. However, its implementation on community-based post-disaster housing reconstruction is hardly found. Accordingly, the objective of this paper is to assess high risk events that affect time completion of community-based post-disaster housing reconstruction project (CPHRP). Three most recent and most severe areas affected by earthquake and tsunami in Indonesia were chosen as case study locations: Aceh (2004), Yogyakarta (2006) and West Sumatra (2009). Questionnaire survey was selected as data collection method and emailed to respondents to assess the probability of occurrence of particular event and its impact on time completion. The response rate was considered as very satisfactory (79%) with sixty five questionnaires were categorized as valid. Result shows that twenty events can be categorised as high risk and are mostly originated from government.

Keywords

Risk assessment, community-based, housing reconstruction

Introduction

Indonesia is one of the most prone countries in the world. Guha-Sapir et al. (2012) reported that Indonesia together with China, the United States, the Philippines and India, are the top 5 countries that are most frequently hit by natural disasters in recent 10 years. The most common types of disaster in Indonesia during this period are floods and earthquakes. Floods and earthquakes respectively contribute to 42% and 26% of total numbers of natural disaster. Although in the last ten years earthquakes only occupied 26% of total number of natural disasters, the death toll and economic damages it caused compare to total impacts are almost 98% (175,341 fatalities) and 89% (US\$10.76 billion) respectively (EM-DAT, 2013). Since the majority of victims in earthquakes are killed by their own collapsed houses, it implies that earthquakes have destroyed many houses and, as consequences, massive housing reconstruction is needed.

Housing reconstruction is probably the most important activity in reconstruction project. It is highly needed by the beneficiaries after the relief period. As a result, delivering a high quality house that can satisfy beneficiaries' expectation is key factor of successful reconstruction programme. However, experiences have shown that the housing reconstruction project was not an easy task and face a lot of problems (ACARP, 2007 and World Vision, 2008). One option of procurement

method that can achieve high satisfaction among survivors is by implementing a community-based post-disaster housing reconstruction project (CPHRP). Nevertheless, this programme is not free from risks that can delay housing delivery, increase construction cost, reduce quality, in which at the end can create dissatisfaction. To deal with the risks, risk management method which have been acknowledge to have positive contribution in achieving project objectives in construction project needs to be conducted.

Considering that whole stage of housing reconstruction project and risk management are very broad area, this paper concentrates on the pre-construction stage of CPHRP and assess the high risk events that affected the project's time completion. The other reason to focus upon the pre-construction phase of a CPHRP is because this phase is identified as one of the most important phases which contributes immensely towards the success of CPHRP. Accordingly, the objective of this paper is to assess high risk events that affect the time completion of CPHRP.

Literature review

Earthquake impacts in housing sector

Located in the juncture of four tectonic plates, Indonesia is frequently hit by earthquake. In recent years, the occurrences of large earthquakes have increased significantly. EM-DAT (2013) records that earthquakes occurrence in Indonesia increase from 14 times in the period of 1980-1989 to 39 times in the period of 2000-2009. In addition, particularly after the 9.0 Richter Scale giant earthquake in Aceh at the end of 2004, USGS (2010) notifies that 38 large earthquakes have taken place compared with only 12 earthquakes between 1992 and 2004. Some of the devastated earthquakes during this period are the 6.3 Richter Scale Yogyakarta earthquake in 2006 and the 7.6 Richter Scale West Sumatra earthquake in 2009.

These three devastating earthquakes have created considerable losses to Indonesian communities. Summary of the fatalities, economic losses and number of houses heavily damaged are given in Table 1. Housing is the most affected sector by earthquakes. In Aceh, losses in the housing sector were over 30% of total damage and loss assessment (BRR and partners, 2006). While in Yogyakarta and West Sumatra, the total losses were highly dominated by the housing sector- 53% and 74% of the total losses respectively (Bappenas et al., 2006 and BNPB et al., 2009). These figures indicate the severity of damage caused by earthquake in the housing sector, thus massive housing reconstruction programmes have been conducted in those affected areas.

Table 1. Number of fatalities, economic losses and housing damage due to earthquakes in Aceh and Nias, Yogyakarta and Central Java, and West Sumatra

No.	Disaster location	Fatalities	Economic losses (US\$)	Housing destroyed/heavily damage
1.	Aceh and Nias, 2004 and 2005	127,720	4.9 billion	139,195
2.	Yogyakarta and Central Java, 2006	5,716	3.1 billion	250,000
3.	West Sumatra, 2009	1,117	2.3 billion	115,000

(source: BNPB et al., 2009; BRR, 2009; Bappenas et al., 2006; JRF, 2010)

Providing good quality housing that can withstand the future disaster and achieving high level of beneficiaries' satisfaction are the ultimate goals in post-disaster housing reconstruction. However, this simple goal is not easy to achieve. Many problems have hampered the success of post-disaster housing reconstruction projects, and often found to be the most challenging sector of entire reconstruction programme.

Community-based approach in housing reconstruction

There are several approaches available in post-disaster housing reconstruction (Jha et al., 2010, da Silva, 2010) and one of them is community-based method. Before discussing further about community-based approach, first it is important to define the definition of community itself and into what extent a programme can be called as community-based. It was based on the fact that many organisations involved in post-disaster housing reconstruction often labelled their programme as community-based, without really understand how it should be done (Davidson, et al, 2007; Dercon and Kusumawijaya, 2007). In the context of post-disaster housing reconstruction, Ophiyandri et al. (2012) define community as a group of beneficiaries for housing reconstruction in which their houses are affected by a disaster. Further, Ophiyandri et al. (2010) suggest that from five level of community participation proposed by Davidson et al. (2007) (namely: manipulate, inform, consult, collaborate, and empower in which the last category community have more power to control reconstruction project), to be name as community-based method, the level of participation of community should be at least at the level of collaboration. In this level, community has significant amount of power to control their own housing reconstruction project.

The implementation of community-based approach in disaster affected areas has been proven as a key success factor in housing reconstruction project (Fallahi, 2007, Lawther, 2009). This method can provide many advantages, both physical and psychological. In construction management perspective, this method can ensure that the traditional objectives (time, cost and quality) in construction project can be met, and as a result it achieves high satisfaction among beneficiaries. In psychological perspective, it can rebuild the social capital, ease trauma and create pride among survivors (Ophiyandri et al., 2012). Despite its advantages, this method is still far from problems (Davidson, *et al.*, 2007; Dercon and Kusumawijaya, 2007, Jha et al., 2010; MacRae and Hodgkin, 2011). The problems that exist in CPHRP can obstruct the project in achieving its objective. A problem is basically negative event or a risk that needs to be identified, assessed, and controlled.

Risk Management

Risk is combination of the probability of an event and its consequence (PD ISO/IEC Guide 73:2002) and is generally used only when there is at least the possibility of negative consequences. Although risk is often associated with negative impact, Hillson (2002) states that risk can also bring positive consequences on project objectives. In this context, risk is defined as an event that can bring negative impact on housing-reconstruction project in achieving its objectives.

Inevitably post-disaster housing reconstruction can be classified as a construction project. The construction project carries more risks and uncertainties compared to other industries such as the manufacturing industry (Hlaing *et al.*, 2008;). Because the post-disaster situation is more complex than a normal situation, the risk for post-

disaster housing reconstruction projects is higher than the construction project in normal environment. Further, considering that every construction project is unique, the risks in involving a community in a disaster reconstruction are very specific and they would be very different compared to normal environment and contractor-based methods. The variations on scale of disaster impact, existence of local culture and wisdom, government capacity and funding availability have made it even more unique. In dealing with risks, the construction industry has acknowledged that risk management is an important factor in achieving project objectives (Kangari, 1995), minimizing losses and enhancing profitability (Akintoye and MacLeod, 1997). However, the implementation of risk management has not yet become a common practice in post-disaster housing reconstruction project (da Silva, 2010). As a result, there is a need to implement risk management process in CPHRP in order to enhance the probability of CPHRP to meet its objectives.

The risk management process is classified in different way by scholars. Thompson and Perry (1992) divide it into risk analysis and risk management, while Boothroyd and Emmett (1996) classify it as risk assessment and risk management. In more detail, Baker *et al.* (1999) states that risk management consists of five stages, risk identification, risk analysis, risk evaluation, risk response and risk monitoring, while Winch (2009) classifies it as risk identification and classification, risk analysis, risk respond, and risk monitoring. However, it is generally the process of identification, evaluation or assessment, respond or treatment and risk communication. Figure 1 shows the concept of risk management process.

Accordingly, this paper focuses on risk assessment stage. According to BS IEC 62198:2001 the purpose of risk assessment is to analyse and evaluate identified risks to determine whether treatment is required. Risk assessment or analysis can be carried out using qualitative or quantitative techniques. Egbu (2009) lists some techniques that can be used on risk management, qualitative techniques such as brainstorming, checklists, Delphi technique, probability-impact (P-I) score tables, interviews and risk register, and quantitative techniques such as decision trees, earned monetary value (EMV), sensitivity analysis, and Monte Carlo simulation. This study conducted interview and literature review as a method for risk identification, while probability-impact analysis is deployed for risk assessment method.

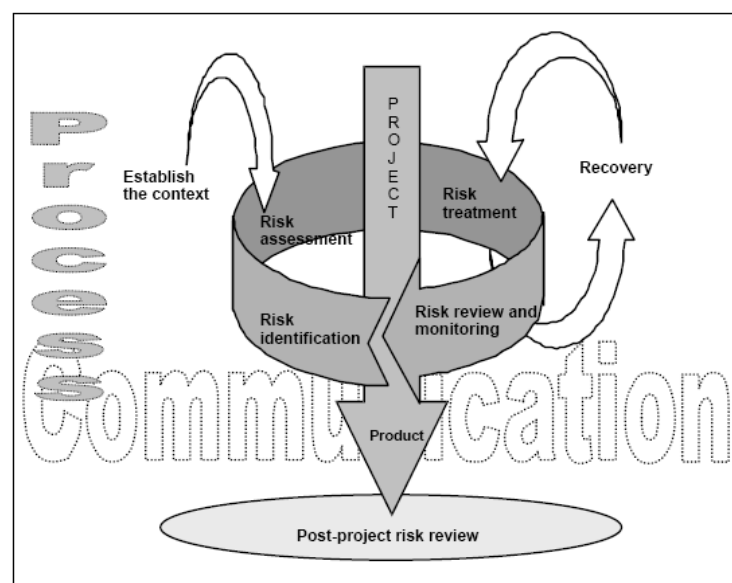


Figure 1. Project risk management concept (BS IEC 62198:2001)

Methodology

A questionnaire survey was conducted aiming to assess the identified risks on CPHRP. Risk identification was carried out through extensive literature review and interviews conducted in Indonesia. Following this step, a structure questionnaire was developed and piloted in November 2011. The results from pilot study required minor revisions to the format of the questionnaire and additions on the risks list. The finalized questionnaire was categorized in 8 activities which consists of 61 risks, and drafted in two languages, English and Bahasa Indonesia. In the questionnaire, respondent was invited to rate the level of probability and impact of particular event on a five-point Likert scale, varying from 'Very Low', 'Low', 'Moderate', 'High', 'Very High'. Guidance on judging the risk impact on project time was provided in the questionnaire and can be seen in Table 2. The risks factor (probability-impact factor) is calculated by multiplying probability factor and impact factor. The identified risk is classified as 'High' if the value of the probability-impact factor is located in the shaded cells of Probability-Impact matrix (Table 3).

Table 2. Risk impact on time (after PMI, 2008)

Project objectives	Relative or numerical scales				
	Very low 0.05	Low 0.10	Moderate 0.20	High 0.40	Very high 0.80
Time	Insignificant time increase	<5% time increase	5-10% time increase	10-20% time increase	>20% time increase

Table 3. Probability-Impact matrix (after PMI, 2008)

Probability	Threat				
	Very low: 0.05	Low: 0.10	Moderate: 0.20	High: 0.40	Very high: 0.80
Very High : 0.90	0.05	0.09	0.18	0.36	0.72
High : 0.70	0.04	0.07	0.14	0.28	0.56
Moderate : 0.50	0.03	0.05	0.10	0.20	0.40
Low : 0.30	0.02	0.03	0.06	0.12	0.24
Very Low : 0.10	0.01	0.01	0.02	0.04	0.08

The questionnaire was administered in December 2011 and completed in February 2012. The survey applied the snowball sampling where some respondents persuaded to inform researcher's other potential respondents to be invited. The questionnaire was emailed to 92 potential respondents and 73 completed questionnaires were received by the researchers, representing a 79% feedback rate. The response rate was considered very satisfactory. Among these 73 questionnaires, 65 questionnaires were categorized as valid. The validity criterion was based on two factors, respondent having had experience in CPHRP and one of the project locations being in Indonesia.

Respondents come from different demographic background. The highest comes from international NGO (35%), followed by consultant (28%), academia (14%), government (12%) and local NGO (11%). Respondents were working in various positions during the CPHRP, ranging from facilitators (29%), consultant/supervisor (29%), advisor (28%), project staff (23%) and project manager (20%). Analysing the respondents' experience in terms of duration and location, it shows that most of respondents have been working for more than six years (80%), on the other hand their working experience in reconstruction were less than six years (75%). This implies that most post-disaster reconstructions projects are a recent phenomenon in Indonesia. The majority of respondents have worked on the reconstruction of Aceh followed by Yogyakarta and Padang. Forty four respondents have been working only in one location, while seventeen respondents and four respondents have been working in two and three different locations respectively. The overlapping of respondent location in reconstruction project is shown in Figure 2. In addition, 91% of respondents have been working in Indonesia while 9% of them have also worked outside Indonesia, such as in Sri Lanka, Pakistan and Haiti.

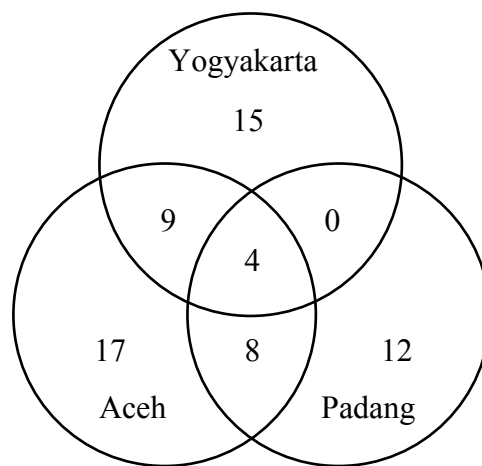


Figure 2. Number of respondents based on project location in Indonesia

Results and Discussions

Data was analysed using Statistical Package for Social Sciences (SPSS) 16.0, including the descriptive statistics, a one sample t-test was also conducted at a 95% significance level with a test value of zero in order to evaluate the significant level of risks statistically. The results of descriptive statistics and one sample t test are shown in Table 4. By analysing the mean value of probability-impact factor of each event and referring it to Table 3, high risk event can be identified. It can be seen from Table 4 that twenty events (in shaded row) out of sixty one events can be categorized as 'high risk' events. Although there is much variation in standard deviation, the result of t-test suggests that the finding is statistically significant as the significant value is very high at 0.00 (less than 0.05).

Table 4. High risk events (shaded row) as perceived by respondents

No	Events	Mean	Stdev.	Test Value = 0			
				t	Sig. (2-tailed)	95% Confidence Interval of the Difference	
						Lower	Upper
A	Initiation stages						
1	Lack of central government capacity	0.187	0.175	8.630	0.000	0.144	0.230
2	Lack of local government capacity	0.222	0.171	10.506	0.000	0.180	0.265
3	Unclear reconstruction policy	0.209	0.182	9.277	0.000	0.164	0.254
4	Lack of implementers/NGOs reconstruction knowledge (in general)	0.179	0.170	8.472	0.000	0.137	0.221
5	Lack of implementers/NGOs community based knowledge (on how it should be done)	0.185	0.176	8.496	0.000	0.142	0.229
6	Failure to manage stakeholders	0.196	0.150	10.518	0.000	0.158	0.233
7	Problems of communication and coordination	0.243	0.172	11.372	0.000	0.201	0.286
8	Unclear roles and responsibilities of stakeholders	0.164	0.140	9.454	0.000	0.129	0.198
9	Inappropriate reconstruction organisations	0.171	0.170	8.106	0.000	0.129	0.214
10	Lack of government support	0.171	0.184	7.463	0.000	0.125	0.216
11	Insufficient funding	0.233	0.218	8.617	0.000	0.179	0.288
12	Tight schedule	0.193	0.183	8.543	0.000	0.148	0.239
B	Facilitators recruitment and training						
1	Shortage of facilitators	0.187	0.172	8.743	0.000	0.144	0.229
2	Lack of facilitators' knowledge and experience	0.202	0.176	9.272	0.000	0.159	0.246
3	Lack of trainers' knowledge and experience	0.141	0.152	7.510	0.000	0.104	0.179
4	Insufficient training materials and unclear outcomes	0.119	0.149	6.408	0.000	0.082	0.156
5	Tight schedule	0.182	0.171	8.598	0.000	0.140	0.224
C	Housing damage assessment						
1	Lack of housing database	0.260	0.201	10.452	0.000	0.211	0.310
2	Too many parties involved	0.232	0.204	9.155	0.000	0.181	0.282
3	Non-uniform assessment method	0.206	0.178	9.358	0.000	0.162	0.250
4	Coordination problems	0.233	0.168	11.172	0.000	0.192	0.275
5	Insufficient numbers of surveyors/facilitators	0.185	0.171	8.711	0.000	0.143	0.227
6	Inexperienced surveyors/facilitators	0.198	0.183	8.750	0.000	0.153	0.243
7	Transportation/access problems	0.305	0.235	10.467	0.000	0.247	0.363
8	Collusion in defining damage category	0.205	0.196	8.438	0.000	0.156	0.253
D	Beneficiaries identification and land tenure						
1	Lack of beneficiaries databases	0.282	0.205	11.045	0.000	0.231	0.332
2	Insufficient numbers of surveyors/facilitators	0.181	0.155	9.452	0.000	0.143	0.220
3	Inexperienced surveyors/facilitators	0.197	0.155	10.199	0.000	0.158	0.235
4	Transportation/access problems	0.259	0.219	9.505	0.000	0.204	0.313
5	Collusion in deciding beneficiaries'	0.211	0.193	8.785	0.000	0.163	0.259
6	Problems with land tenure/rights	0.280	0.233	9.679	0.000	0.222	0.338
7	Validation problems	0.272	0.216	10.164	0.000	0.218	0.325

No	Events	Mean	Stdev.	Test Value = 0			
				t	Sig. (2-tailed)	95% Confidence Interval of the Difference	
						Lower	Upper
E	Programme socialisation						
1	Shortage of facilitators	0.171	0.159	8.691	0.000	0.132	0.210
2	Inexperienced facilitators	0.183	0.154	9.554	0.000	0.144	0.221
3	Lack of local government support	0.152	0.152	8.074	0.000	0.114	0.190
4	Competition between donors/implementers/NGOs	0.157	0.152	8.303	0.000	0.119	0.195
5	Community resistance	0.178	0.169	8.506	0.000	0.136	0.220
6	Failures in community meetings	0.179	0.164	8.826	0.000	0.139	0.220
7	Tight schedule	0.191	0.186	8.280	0.000	0.145	0.237
F	Forming community organisation						
1	Inexperienced facilitators	0.176	0.150	9.464	0.000	0.139	0.213
2	Failure to establish community organisations	0.153	0.154	8.010	0.000	0.115	0.191
3	Community resistance	0.159	0.139	9.278	0.000	0.125	0.194
4	Community leader too dominant	0.171	0.159	8.630	0.000	0.131	0.210
5	Community is manipulated by other parties	0.168	0.146	9.264	0.000	0.132	0.204
6	Disagreement on community contract/consensus	0.163	0.147	8.967	0.000	0.127	0.199
7	Tight schedule	0.153	0.138	8.926	0.000	0.119	0.188
G	Community/labour training						
1	Facilitators shortages	0.165	0.153	8.672	0.000	0.127	0.203
2	Inexperienced facilitator	0.175	0.151	9.307	0.000	0.137	0.212
3	Labour shortages	0.237	0.178	10.729	0.000	0.193	0.281
4	Limited knowledge by labour of how to construct earthquake resistant houses	0.236	0.178	10.721	0.000	0.192	0.280
5	Insufficient training materials and unclear outcomes	0.131	0.124	8.570	0.000	0.101	0.162
H	Housing design and material						
1	Inexperienced facilitators	0.137	0.134	8.208	0.000	0.104	0.170
2	Lack of facilitators' technical knowledge	0.134	0.124	8.710	0.000	0.103	0.164
3	Unclear building code	0.135	0.138	7.897	0.000	0.101	0.169
4	Too many variations put forward by the community	0.179	0.146	9.837	0.000	0.142	0.215
5	Too many cultural considerations	0.157	0.159	7.966	0.000	0.118	0.196
6	Unconfirmed source/type of materials	0.150	0.152	7.959	0.000	0.113	0.188
7	Material price increases	0.251	0.191	10.580	0.000	0.204	0.298
8	Tight schedule	0.160	0.155	8.302	0.000	0.121	0.198
9	Limited budget	0.178	0.157	9.180	0.000	0.140	0.217
10	Too much paperwork prior to initial payment at start of construction work	0.244	0.205	9.576	0.000	0.193	0.294

From 8 groups of activities in CPHRP, respondents perceived that only two group do not contain high risk events, programme socialisation and forming community organisation. Many high risk events present in initiation stage, damage assessment and beneficiaries' identification. Three high risk events in initiation stage are originated from government. They are lack of local government capacity, unclear

reconstruction policy, and failure in managing coordination and communication. Simplified the bureaucratic process and controlling material prices is another challenge for government in speeding up the reconstruction process. This fact suggests that increasing government capacity to tackle future disaster is highly needed.

In damage assessment and beneficiaries' identification stages, the pace of CPHRP is hampered by lack of database. Database on how many houses are affected, how severe is the destruction, and who is eligible to receive the assistance are the common problems took place during CPHRP. Although community-based approach can minimise collusion, the lack of database can create a chance for survivors to do a conspiracy in deciding the damage category and eligible beneficiaries. It turns the validation process to become a long process. Thus, developing an up-to-date database system is immensely important. It has to be created long before the disaster struck. Further, clearly trouble-free access to the affected areas play an important role to guarantee that the housing reconstruction can be delivered as scheduled.

In the aftermath of earthquake, many organisations quickly provide assistance to assess the safety of houses if it should be occupied by the survivors. The problem emerges because organisations sometime bring their own assessment method. Then, when official assessment is carried out by government, and there is a difference in damage category, it creates confusion and dissatisfaction among beneficiaries, especially when the damage category is lowered down. For instance, when damage category is changed from heavily damage to moderate, beneficiaries will make a big complaint because it relates to the amount of fund they will receive in the future. The process of giving an explanation and understanding to the beneficiaries can consume a lot of time. As a result, providing uniform assessment method from the very beginning is essential to achieve time objectives of CPHRP.

Moreover, in facilitator recruitment and training, respondents perceived that lack of facilitator knowledge and experience can restrain the reconstruction process. Same condition take place in community/labour training where respondents also suggest that lack of knowledge of labour on how to construct earthquake resistant house and together with their shortages are high risk events that affect the time completion of CPHRP.

Conclusions

Several activities in pre-construction stage of CPHRP can be categorised as high risk and are mostly originated from government. Lack of government capacity can lead to unclear reconstruction policy, problems of communication and coordination, and long bureaucratic process. Moreover, lack of housing and beneficiaries' database, and their validation have been perceived by respondents as other obstacles in speeding up the reconstruction process. It exacerbated by lack of facilitators' knowledge and experience, and labour shortages. Insufficient funding and increasing of material prices have also been acknowledged to be the problems that can slow down the reconstruction programme. As a result, by giving much attention on above high risk events and creating possible solution prior to disaster, it is hoped that the success of CPHRP can be enhanced.

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Design of Sustainable Multi-Storey Building Applying the New Estidama Rating System

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Abstract

Relatively new development and demand of sustainable/green buildings has been growing in recent years in the world in response to increasing concerns on both climate change and the declining supply of fossil fuel resources. Certain building materials are considered “greener” than others because they have qualities that minimize their impact on the environment and the planet. Materials such as, nontoxic, renewable, sturdy, re-cycled products may be considered green. There are few newly developed organizations and rating systems in the world dedicated on sustainability and green construction such as: UK Green Building Council, US LEED and Estidama in Abu Dhabi/UAE. Estidama applies rating system between 1-5 Pearls. To achieve 1 Pearl rating, all the mandatory credit requirements must be met. However, to achieve a higher Pearl rating, all the mandatory credit requirements must be met in addition to extra selected minimum number of credit points. In this research Estidama system was applied on multi-storey building to evaluate its rating. The second part of the research focuses on the development and use of structural light weight concrete in the building and measure its new rating. Results showed reduction in total carbon foot print and thermal insulation cost which resulted in changing the status of the building from no rating to 1 pearl rating according to Estidama measures.

Keywords

Sustainable building, carbon foot print, Estidama system rating, structural lightweight concrete.

Introduction

Sustainable development and the need to maintain the balance between environment, economy and society has become the pressing goal that is facing the communities, enterprise organizations, government and the world at large. Green building technology has emerged as solution for sustainability in the construction world. It is about the building technology that optimizes the use of natural sources as well contributes to the sustenance and maintenance of the natural environment, that otherwise has been threatened by modernization as well as human irresponsibility. The benefits of implementing sustainable practices in construction can improve regulatory compliance; reduce harmful impact and pollution (Bansal, 2002). Over use of construction materials in the recent years has affected ozone depletion in the atmosphere in separate locations due to the release of disproportional amount of carbon than the atmosphere can handle (Andersen, 2006). Green building is the practice of: increasing the efficiency with which buildings and their sites use and harvest energy, water, and materials, and reducing building

impacts on human health and the environment, through better site planning, design, construction, operation and maintenance. Therefore, it is clear that sustainability aims at utilizing natural resources in more efficient ways and also at optimizing the effectiveness of the building processes in terms of its impact on human health and the environment. Nowadays, the majority of the world's population lives in urban places, and it is forecasted that by 2015, there will be 23 "mega cities", and 19 of them will be located in developing countries (Lopez, 2010). This rapid growing of the population and the huge expansion of urban areas has led all the nations and even other creatures to compete for resources. Urban regions are known for their extensive use of natural resources and prolific generation of waste substances. They also import goods and services, and export waste products, leaving an impact not only on their immediate environment but also on distant environments over a longer time period. The challenge of civic authorities is to provide adequate living conditions, water, sanitation, public transportation, and waste management features prominently in all urban development policies and action programs. Today, we are painfully beginning to learn that environmental resources are limited and are quite sensitive to everything that we do. We are starting to experience the effects of the actions of generations that came before us. To make sure that future generations will not experience worse, we need to be aware of the ideals and requirements of sustainability. As we become aware, we need to put what we learn into action as that is the only way we can allow nature to catch up with the rate at which our requirements grow. This does not mean having to stifle human development. On the contrary, it means sustaining the supply of resources so that we can, in turn, sustain human development. Consumption of living resources as raw material and waste materials is high and growing (Wackernagel & Rees, 1996). Going green in construction is to decrease pollution factors of buildings such as carbon dioxide release and reduce carbon dioxide foot prints, and reduce the high energy consumption. However, pollution and sustainability is a very broad subject which consists of many problems and alternative solutions by different scientists and engineers wanting to save serve and solve problems of their concern and major. Green construction is a dynamic field that is always evolving with advent of technology, economy, and social change. Culture is another principle dimension of sustainable development that relates to educational level and behaviour attitude of given society (Blackburn, 2007).

Estidama

Estidama is one of those concepts. Estidama is primarily a sustainability program supervised by the government Abu Dhabi Urban Planning Council, together with the Municipal System in order to realize several goals and aspects regarding planning for the next generation and becoming the icon of inspired vision for both governers and community development. It is becoming mandatory to apply on buildings in the UAE starting from the city it launched from, Abu Dhabi. Its main objective or motto by means is to ensure that sustainability is addressed on a regular basis and focused on all main pre-defined angles, which are cultural, environmental economic and social. Estidama's purpose is to embrace the rapidly changing concepts for sustainability and ground them in all angles based on the needs of the emirates. It evolved based on the need to properly plan, design, construct and operate sustainable developments, with respect to the traditions embedded within the rich local culture and not forgetting its cultural identity as well as dealing with its harsh climate nature of the region. Based on Estidama's highly esteemed vision

sustainability is achieved as improving quality of life for residents by applying four equal pillars: Environmentally, Economically, Socially and Culturally. Figure 1 shows Estidama system.



Fig. 1: Estidama System (<http://www.estidama.org>)

Pearl Building Rating System (PBRs)

Achievement of a sustainable building requires the four pillars of Estidama together with a collaborative and inter-disciplinary approach to building development known as the Integrated Development Process. The PBRs encourages water, energy and waste minimization, local material use and aims to improve supply chains for sustainable and recycled materials and products. In May 2010 shows all the new buildings must meet the 1 Pearl requirements starting in September 2010, whilst all government funded buildings must achieve minimum 2 Pearls. Following this mandate, significant effort has been made to align the PBRs with the Abu Dhabi Development and Building Codes.

Methodology

An existed multi-storey building was selected and analysed to:

A. Evaluate the building against Estidama's sustainability specifications and calculating the buildings total rating system based on Estidama to evaluate whether it meets Estidamas' sustainability requirements or not.

B. Design structural lightweight concrete and use it in the building to evaluate saving in materials, service life cost of the building and calculate the new Estidama rating. The existed building used normal weight concrete with compressive strength of 40 Mpa and normal density of 2400 kg/m³.

Design of Structural Lightweight Concrete:

Light weight concrete is by its name a material that has the exactly same properties as the Normal weight concrete, only that is lighter than the normal weight concrete and it has less strength. Normal weight concrete usually reach up to 55 MPa, with a density of 2400 kg/m³, while light weight concrete can have strength between 25 MPa and 30 MPa with less density 1750 kg/m³ and 1850 kg/m³. The idea of

making light weight concrete is to make a good concrete mix that is lighter than the normal light weight concrete and has a reasonable strength. This is done by replacing the normal aggregate such as limestone and granite by lighter aggregate which is pumice. Also, one can play with mixture by modifying the amount of water and the superplasticizer. These modifications on the amount of water, superplasticizer, and the balances and changes in the properties of the mixture can make significant changes in the results, such as: Lighter Materials will reduce the amount of dead load of the structure, thus easing the design and construction processes and reduce materials and cost. Increasing the efficiency and Life-Span of the structure by using materials that are more environmental friendly, increasing the thermal insulation and the fire resistance.

Penetron is a new construction material used to reduce concrete water absorption. This material has chemical movement in the molecular basis which penetrates through the concrete by pressure of osmosis and dry particle reactions. The active ingredients of PENETRON chemicals react with various concrete minerals which forms an insoluble crystalline shaped material which fill out cracks, pores and voids up to a width of at least 400 microns. This crystalline growth will eventually take place far inside the concrete structure or object and has been found as deep as nearly 1 m from the point of interest. Water molecules (and a wide range of chemicals) lose the ability to create passage through the concrete. However, air can still pass giving the concrete a place to breathe and avoid vapour pressure to build on the structure from the outside body of the structure.

The concrete mixture design procedure is initiated by selecting four different mix characteristics or materials

Proportions in the following sequence:

Step 1: Selecting the Water/ Binder Ratio

Step 2: Selecting the water content

Step 3: Selecting the superplasticizer dosage

Step 4: Selecting the coarse aggregate content.

Selecting the Water/ Binder Ratio:

The selected water/ binder ratio can be found from the following figure for a given compressive strength at 28 days (measure on a 100 x 200 mm faced cylinders).

Results and Discussions

Table 1 shows the mixture compositions of seven concrete designs that were tried in the laboratory to reduce the overall density of the concrete yet keeping its compressive strength high.

Table 1: Composition of seven concrete mixtures

Mixtures		1	2	3	4	5	6	7
Cement (kg)	432	5.184	5.184	5.184	5.5	5.5	5	5
SF (kg)	48	0.576	0.576	0.576	0.7	0.7	0.7	0.7
20mm	510	6.12		6.12	6.3	3.33	1.6	1.6
10mm			4.896			1.66	1.6	1.6

LWA (dry)	405.6	4.87	4.383	4.87	5	6.3	6.3	6.3
DS	260	3.12	3.43	3.12	3.64	3.5	3.12	3.12
Water	270	2.33	2.23	2.33	3.61	2	2	3.5
W/C	0.625	-	-	-	-	-	-	-
Super.	4.17	0.05	0.05	0.05	0.07	0.07	0.07	0.01
Unit Weight (kg)	1930. 395							

Measurements in the laboratory were carried out to determine the relation between concrete density and the level of compressive strength. Table 2 shows average compressive strength of 42 Mpa is produced with low average density of 2190 kg/m³.

Table 2: Mechanical properties of mixtures 1 and 2

Mix #	Cube #	Mass in water (g)	Dry mass (g)	Stress 7days (Mpa)	Stress 28days (Mpa)	Density (kg/m3)
1	1	1150	2090	39.2	52.3	2220
1	2	1170	2100	44.7	59.6	2260
1	3	1100	2080	24.4	32.5	2120
1	4	1120	2083	31.0	41.3	2160
1	5	1199	2120	24.1	32.1	2300
1	6	1070	2050	23.7	31.6	2090

Density	2190 kg/m ³
Avg stress	41.6 Mpa

Mix #	Cube #	Mass in water (g)	Dry mass (G)	Load at failure 7days (Mpa)	Load at failure 28days (Mpa)	Density (kg/m3)
2	1	1150	2140	45.0	60.0	2160
2	2	1125	2140	60.0	80.0	2110
2	3	1115	2190	44.0	58.7	2040
2	4	1105	2130	61.6	82.1	2080
2	5	1113	2130	33.1	44.2	2090
2	6	1090	2110	58.8	78.4	2070

Density	2090 kg/m ³
Avg stress	67.2 Mpa

Results showed that mixture two has performed well compared with mixture 1. It produced higher compressive strength of 67 Mpa with lower concrete density of 2090 kg/m³. Therefore it was decided that this concrete will be used in the building to replace existing normal weight concrete. Applying structural lightweight concrete to replace the old concrete has reduced the dead load of the building from 69,000,000 tons to 54,000,000 saving 14,000,000 tons of concrete materials. It

means large reduction in the use of cement and aggregate which are the main source of carbon foot print due to their high embodied energy.

Water absorption test:

Table 3 shows the results of the water absorption ratio for the three samples: normal light weight concrete and two other samples using new insulated materials called penetron.

Table 3: Water absorption tests

Speciment No.	1	2
Water Absorption (%)		
30 minutes immersion	3.6	3.6

Concrete treated with penetron insulated material

Speciment No.	1	2
Water Absorption (%)		
30 minutes immersion	1.6	1.6

Penetron insulated material applied on the surface of the concrete specimen

Speciment No.	1	2
Water Absorption (%)		
30 minutes immersion	3.1	3.1

The results showing 45% reduction in the water absorption when using penetron materials mixed with the concrete and 14% reduction when the insulated materials applied to existing surfaces.

Conclusions

1. Using structural lightweight concrete and insulated materials has raised Estidama rating of the building by 70 credits.
2. Replacing existing concrete with the new structural lightweight concrete has resulted in reducing the materials quantities, thus saving cost and conserve materials.
3. The results showed reduction of the carbon foot print when using lightweight structural concrete. This is mainly associated with using less cement and aggregate which have high embodied energy.
4. Using insulated materials has resulted in improving the water resistance of the building by 14%-45% protecting it from long term corrosion deterioration. This will reduce maintenance cost in the long term and the overall service life cost.

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Assessment of Performance of Expanded Polystyrene as an Alternative Building Material in Nigeria

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Abstract

Over the years, sandcrete blocks have been the most widely used wall construction material in Nigeria. Polystyrene that has been reinforced with wire mesh have also been used for this purpose. In developing countries like Nigeria, very limited studies are reported about the usage of expanded polystyrene (EPS) core as a construction material. This research work investigated polystyrene in its application as an alternative material suitable for the construction of buildings with emphasis on aspects such as cost, construction time, labour requirements, thermal and sound insulation and other related properties. Primary data was collected using well structured questionnaire which was administered on the residents of the study area (CITEC Estate, Abuja) to gather their opinions about the use and performance of polystyrene in buildings. The data obtained from the study are presented in tables and charts and analysis were performed on them using percentages and Relative Importance Index (RII). The material performs well in resisting fungal and bacteria attack, damage by chemicals and moisture penetration but poor in ageing, resisting wear and tear and compression. Some challenges faced with the use of the material are inadequate capacity for mass production locally, dearth of information about it and the problem of importation. Suggested solutions include creation of a data bank on the material, developing the appropriate skills required for sourcing the raw material and ensuring sustained availability of alternative materials by government and other stakeholders as well as encouragement of local production and development of codes and standards to regulate its use. The study reveals that the use of this material saves time and cost and more studies to understand its behaviour better are recommended. Its production in large quantities locally for mass housing is also advocated.

Keywords

Expanded polystyrene, alternative building material, building components, building performance and challenges.

Introduction

Over the years, sandcrete blocks with sand and cement as the major constituents have been the predominant material for wall construction in Nigeria. The problems associated with the manufacture of cement such as high energy demand and degradation of the environment in the process of sourcing the raw materials (limestone, clay and gypsum) inter alia has brought about the need for researches into alternative materials that have the potentials to serve in a similar capacity with

less adverse effects on the environment. Expanded polystyrene panels are one of such materials.

Another very important factor in the consideration of any material for application in construction of any type is cost. Many aspiring house owners in Nigeria have had their aspirations short lived because of the exorbitant cost of procuring the materials needed for construction of their buildings of which cement is a major factor to the capital intensive nature of its production (mining and transport of the raw materials, etc). This study is not preempting that the use of EPS will be cheaper but it is worth exploring.

Other desirable qualities of EPS that makes it a good material for construction of buildings are its light weight, ability to be made into any colour, lower labour requirement and speed of construction. Emmitt and Gorse (2005) listed ability to be recycled and reused among other conditions to be fulfilled by any material for construction of buildings and recyclability is one of the desirable qualities of EPS. Dearth of information about the use of the material for construction of buildings in Nigeria is also a motivating factor for this study.

This study assessed the performance of EPS core panels for building with a view to understanding its behaviour better for increased application. This was achieved by reviewing related literatures on expanded polystyrene core especially in its use as a construction material, by estimating the amount of time and labour required for the erection of a building using EPS core panels in comparison to the use of sandcrete blocks as well as estimation of the percentage savings on the cost of construction using EPS core panels when compared to the use of sandcrete blocks.

Literature Review

In the provision of shelter, the main construction costs are for building materials (about 60%), (Kerali, 2001; Aguluka, 2003). The conventional basic building materials include amongst others cement, sand, gravel, water and sandcrete blocks of various sizes of 100mm, 150mm and 225mm. These various materials constitute the components that perform peculiar functions. These components include foundation, floor, walls, ceiling, etc. Selection of materials must be based on a good understanding of the material. There is a need to know how the material will perform over a long period of time and how much maintenance it will require during the life of the structure (Opoko, 2006).

Polystyrene (PS) is a multipurpose polymer that is used in varied applications in rigid and foamed form. General purpose polystyrene (GPS) is clear and hard which is used in packaging, laboratory ware, and electronics. Polystyrene foam or expanded polystyrene as it is more often referred to, is mainly used within the packaging industry as a high impact packaging solution to protect a large range of products from damage during transport or storage. Other uses also include construction, for insulation, lightweight ceiling tiles and sometimes even as polystyrene building blocks for concrete to be poured into to create walls (Anonymous, 2011).

The polystyrene panel system is a unique type of building system which employs the use of expanded polystyrene to give the building its form and the intricate galvanized steel wire mesh, fastened by electro-welds on both sides of the

polystyrene and bound together by transverse welds giving the panel a reinforced member that covers every square meter of the panel. The meshed polystyrene slab is then sprayed with concrete to achieve its full structural capability. Blain-Cosgrove (2002) described the EPS core building system as been composed of an expanded polystyrene (EPS) panel core, wrapped in polymer mesh and covered with stucco on both sides. The result is a highly resource and energy efficient building envelope system. The system described by Blain-Cosgrove is slightly different from the one used in CITEC estate in terms of the reinforcement and finishing materials but the principles behind both are similar. The Environmental Protection Agency in Basbagill (2008) describes EPS as a non-emissive plastic. It is made with neither CFCs nor HCFCs and is expanded with the hydrocarbon n- pentane. The U. S. Department of Interior also in Basbagill (2008) notes that pentane contributes to smog but not ozone depletion or global warming. It also exhibit low toxicity. The advantages associated with the use of EPS panels for building are that it can be used to construct high performance building envelopes that can be built quickly, with low-skilled labour, at low cost and with materials that are readily available, affordable, energy efficient, with minimal environmental impact, and occupant health.

Reed and Lee (1994) stated that because the foam of EPS has closed cell, the material is resistant to water penetration and will not transmit water by capillary action, however it is not a water vapour barrier. They added that even though EPS is resistant to alkali and dilute organic acids, it is unstable in most organic solvents. It is also prone to denting and fracture and must be stored carefully on site to protect it from direct sunlight, damp and exposure to wind which might damage it. Mihai et al (2007) gave ability to absorb shock, versatility, resistance to moisture and low thermal conductivity inter alia as some of the properties that makes EPS a suitable material for construction of some building components. Also polystyrene is a thermoplastic and therefore can be recycled and reused indefinitely (Stefano et al, 2010). Thermosetting plastics cannot be re-melted but thermoplastics have the potential to be recycled and changed into different types of recycled polystyrene by altering its properties (Othman et al, 2008).

Methodology

Primary data was generated through the administration of well structured questionnaire to the residents of the study area (CITEC, Abuja) in which the construction of some elements of all the buildings have been done using polystyrene. Physical visit to the area was carried out in order to find out how much time and labour is required for the erection of buildings using EPS core panels and general investigation of the buildings was used to generate data in relation to the stated objectives. The questionnaire was designed to collect information on the socio-economic factors, type of material used for the construction of various components of the buildings, the users' assessment of the performance of the materials, challenges faced with the use of the material in construction and the possible solutions to those challenges. Some comparisons between polystyrene core and sandcrete blocks were carried out to evaluate cost and time. A checklist was also completed by the producing company. The intent of this research was basically to assess the use of EPS core in its application as an alternative construction material as compared to the very popular sandcrete blocks.

The data obtained from the study are presented in tabular and chart forms and analysis were performed on them using percentages and Relative Importance Index (RII) using this equation: $RII = \sum w/AN$

Where w = weighting given to each performance criteria by the respondents and ranges from 1-5 and 1-3 in this study where 1= poor and 5= excellent, 1=disagree and 3=strongly disagree; A=highest weight (five and three in this case); and N= total number of sample.

Findings

A total of 60 questionnaires were administered as shown in table 1 to building occupants and 43 (71.6%) were properly completed and returned and used to analyze the results.

Table 1: Distribution of Questionnaires Source: Field Survey, 2012.

Questionnaires	Percentage	Number
Distributed	100	60
Returned	71.60	43
Not returned	28.30	17

A total of 60 questionnaires were administered to building occupants and 43 were properly completed and returned (71.6%) which was in turn used in the analysis done in this study.

Socio-economic factors

Table 2: Socio-economic status of respondents Source: Field Survey, 2012.

Response	Frequency	Percentage
Business	16	37.21
Civil servant	24	55.81
Others	3	6.95
Total	43	100

Results in table 2 indicates that 37.21% of the respondents are into business, 55.81% are civil servants which is the highest and the other professions takes 6.95%. This shows that a majority of the residents are government workers followed by business men.

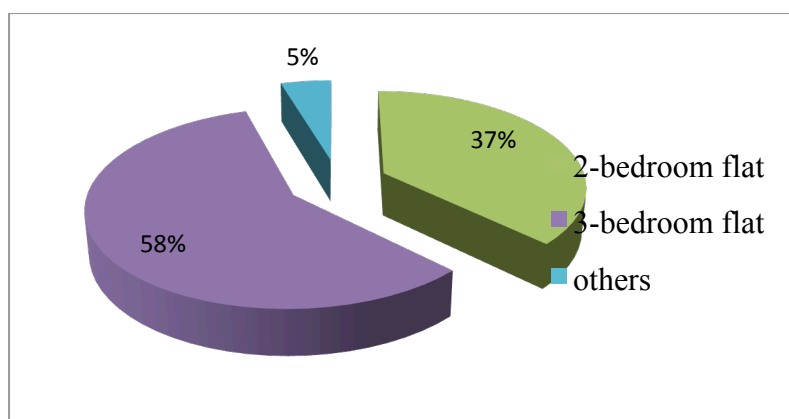


Figure 1: Size of houses occupied. Source: Field Survey, 2012.

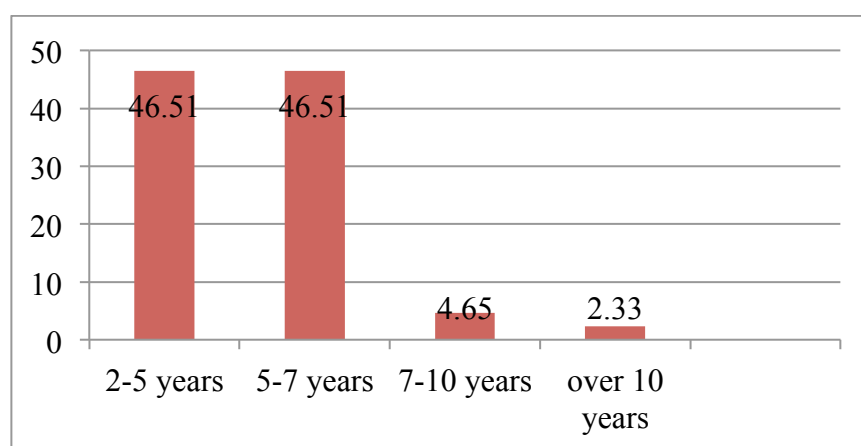


Figure 2: Years of occupancy of the buildings.
Source: Field Survey, 2012.

The information in figure 1 shows that 58% of the houses are three-bedrooms flats, 37% are two bedrooms flats and 5% represents other forms of houses not indicated. This study indicates that 95% of the population surveyed falls within the middle class households.

From figure 2, 46.51% of the respondents have stayed in the estate for 2-5 and 5-7 years each, 4.65% of them have been there for 7-10years and 2.33% have lived there for over 10years. All the respondents have had at least two years experience of the buildings constructed with polystyrene panels and can be said to be in a position to give a fair and realistic assessment of the material. Since over 95% of the respondents have stayed for not more than 7 years, the technology can be said to be still relatively new in Nigeria.

Materials for construction of building components

Attempts were made to find out the materials that have been used for the construction of various components of the buildings such as floors, walls and ceilings so as to know the extent of the application or otherwise of EPS.

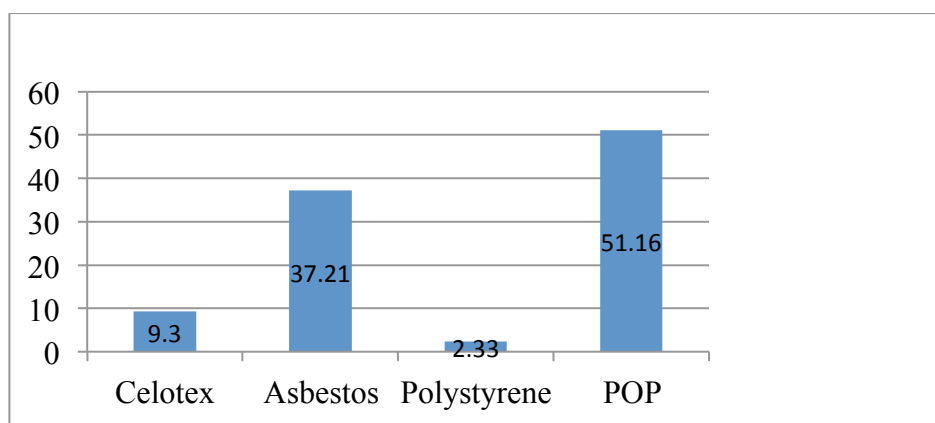


Figure 3: Common ceiling materials Source: Field Survey, 2012.

Figure 3 has shown that POP is the most used material for ceiling construction in the estate (51.16%), followed by asbestos (37.21%), celotex (9.30%) and polystyrene (2.33%) is the least used for ceiling construction.

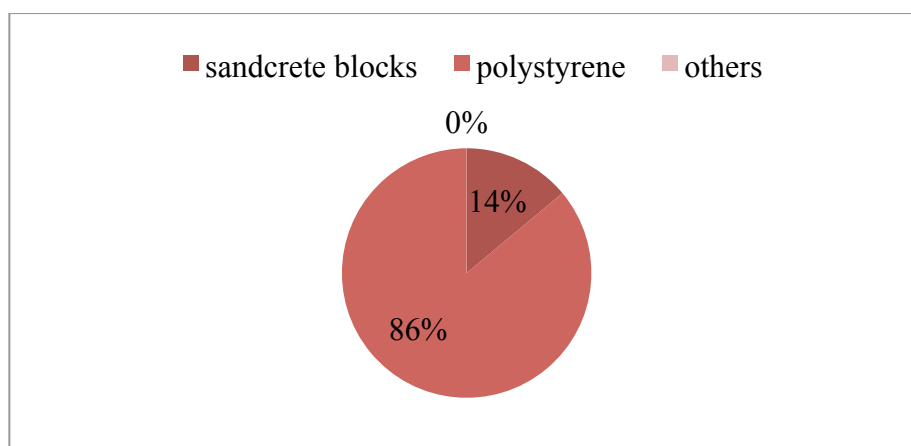


Figure 4: Common walling Materials Source: Field survey, 2012

It can be seen from figure 4 that 86% of the houses surveyed have their walls constructed of EPS while the walls to 14% are made of the conventional sandcrete blocks. The wall is the component of buildings that EPS is mostly used for constructing in the few cases of its application in buildings in Nigeria.

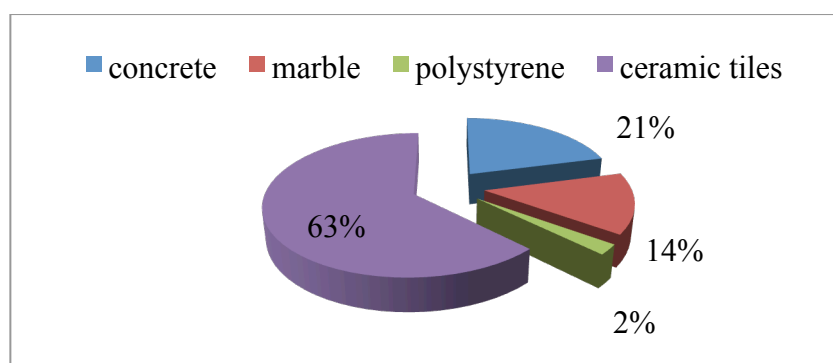


Fig 5: Types of floor finish materials in common use Source: Field Survey, 2012.

Figure 5 has revealed that as it is now, polystyrene is not much used for finishing of floors. Only 2% of the houses surveyed have their floors finished with polystyrene as against 63%, 21% and 14% for ceramic tiles, concrete and marble respectively.

Rating of performance of polystyrene

Table 3 ranked the performance of expanded polystyrene in its use as a construction material. A Likert scale of 5-1 was adopted (where 5= excellent, 4= very good, 3= good, 2= fair, 1= poor).

Table 3: Rating of the performance of polystyrene Source: Field survey 2012

Performance	Frequency					RII	Rank
	5	4	3	2	1		
Resistance to impact	11	25	7	0	0	0.82	5
Resistance to passage of heat	16	19	7	1	0	0.83	4
Moisture resistance	17	20	6	0	0	0.85	3
Resistance to compression	1	20	21	1	0	0.70	9
Resistance to chemical attack	21	18	2	1	1	0.87	2
Resistance to fungi and bacteria	25	15	3	0	0	0.90	1
Resistance to wear and tear	4	21	17	1	0	0.73	8
Permeability by water	17	17	0	0	4	0.82	5
Versatility	20	13	10	0	0	0.85	3
Ageing resistance	3	24	16	0	0	0.74	7
Resistance to passage of sound	11	26	6	0	0	0.82	5
Ecological friendliness	4	33	6	0	0	0.79	6

Table 3 shows the relative importance indices and ranking of the performance of polystyrene core in its use as a material for construction of buildings based on the users' perception. Resistance to fungal and bacteria attack ranked highest with relative index of 0.90, followed by resistance to chemical attack with relative index of 0.87, versatility and Moisture resistance both with the same relative index of 0.85, resistance to passage of heat, resistance to impact, permeability by water and resistance to passage of sound all with relative indices of 0.82 each, ecological friendliness, ageing resistance, resistance to wear and tear with RII of 0.73 and lastly resistance to compression with relative index of 0.70. This result shows that the material can be adopted in the construction conveniently because of its high resistance characteristics.

From this table, the users of the material have judged that the best qualities of EPS are its ability to resist attack from fungi and bacteria, resistance to chemical attack, resistance to moisture, ability to be used for many purposes and insulating properties. However, the material has the limitation of being easily compressed, susceptibility to wear and tear and aging easily.

Table 4: Challenges faced with the use of polystyrene in construction Source: Field survey, 2012.

Challenges	Frequency	Percentage	Rank
Inadequate information about the building material	37	86.04	2
Inadequate capacity for mass production	38	88.37	1
Continuous importation of the material into the country	31	72.10	3
Lack of codes & standards to regulate its use	17	39.53	6
Scarcity of the material	28	65.12	4
Insatiable craving for glamorous lifestyle	37	62.79	5

According to the respondents, the greatest problems with the use of EPS are inadequate capacity for mass production of the material locally, dearth of information about it and the problem of importation. Other problems are non availability in sufficient quantities and lack of codes and standards to guide the application of the material in Nigeria.

Table 5: Suggested solutions to the identified challenges Source: Field survey 2012

Suggested Solutions	Frequency			RII	Rank
	3	2	1		
Creation of a data bank on alternative building materials.	29	14	0	0.89	1
Develop appropriate skills for sourcing the raw material.	24	18	1	0.84	2
Encourage local production by reducing importation.	22	18	3	0.81	4
Development of standards for alternative building materials	16	27	0	0.79	5
Government and other stakeholders should ensure sustained availability of alternative materials	21	22	0	0.83	3

Table 5 ranked the suggested solutions to the challenges faced with the use of polystyrene for construction in Nigeria (Where 3= strongly agree, 2= agree, 1= disagree).

The table shows the relative importance indices for the suggested solutions to the challenges faced with the use of expanded polystyrene core as an alternative construction material. The solution that ranked highest is the creation of a data bank on all alternative building materials, followed by development of the appropriate skills for sourcing the raw material and ensuring sustained availability of alternative materials by government and other stakeholders. The others are encouragement of local production and development of codes and standards to regulate the use of the material. The result shows that insufficient information about the material is the major setback encountered in its use as a material for construction.

Comparative merits of EPS over sandcrete blocks

These are comparative merits to further demonstrate that polystyrene in its use as an alternative building material can conveniently in the same capacity as the conventional sandcrete block building methods with specific advantages in some aspects as stated below. This information was obtained from CITEC, the company that has constructed an estate in Abuja with this material.

Qualities of the Material

A correctly executed panel will achieve better structural characteristics than any block work, because the finish product on the panel will be reinforced concrete, which has a better tensile and compressive strength. Other advantages include its insulating and acoustic properties which are superior to those of the conventional block work.

Speed of construction

The system of building with polystyrene panels offers a unique construction technique that saves time in construction. Comparatively, building four walls 3.6 meters long and 3 meters high will require approximately 450 number of traditional sandcrete blocks. The work will take two masons and two labourers about three days to complete while also taking into consideration that it is advisable not to lay more than six courses in a day. Productivity of one mason is 80 blocks per day maximum below waist level, and as little as 60 blocks above waist level up to the head course. It should also be noted that 1 or 2 days must be added to prepare formwork and cast lintels for openings. However, with the polystyrene panel, the same area will require only 12 panels. Setting up three panels per wall (which is light weight) will take 2 persons a day to set up all four walls, brace them and cut out windows and doors. They can then be sprayed the next day. Therefore 4 days using conventional construction technique can be cut down to half the time using polystyrene panel system.

Cost of construction

To achieve a complete superstructure, less fittings and finishes will be required using polystyrene. Panels will cost approximately 10% more in priced materials, but saves up to 30% in formwork for suspended slabs, 100% in formwork and reinforced concrete in openings and up to 70% savings on labour is achievable for erection of walls. Above all, the traditional overhead cost incurred from long

construction duration is eliminated on super structural development by 50% or more depending on project management. The panel system will save time in construction. This building system is most favoured for mass housing projects where delivery deadlines cannot be allowed to run up the cost of interest on borrowed money or where construction budgets must not be rubbished by inflation.

Conclusions and Recommendations

It has been concluded from the study that the best qualities of EPS are its ability to resist attack from fungi and bacteria, resistance to chemical attack, resistance to moisture, ability to be used for many purposes and insulating properties. However, the material has the limitation of been easily compressed, susceptibility to wear and tear and aging easily. Also the greatest problems with the use of EPS are inadequate capacity for mass production of the material locally, dearth of information about it and the problem of importation. Other problems are non availability in sufficient quantities and lack of codes and standards to guide the application of the material in Nigeria. Another important conclusion is that it takes half the time for construction with conventional sandcrete block when using EPS. Reasonable amounts of savings on cost of formwork, reinforcements, labour and general construction cost are also possible.

The creation of a data bank on all alternative building materials, development of the appropriate skills for sourcing the raw material, ensuring sustained availability of alternative materials by government and other stakeholders, encouragement of local production and development of codes and standards to regulate the use of the material are recommended. The technology is recommended for use in housing production where deadline for completion is an issue of concern as well as for mass housing projects.

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Interpretation and Determination of Thermal Comfort in Climate Change Context

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Abstract

Thermal comfort is a complicated subject and is thus hard to quantify generally and specifically and the existing quantification methods are unlikely to be reliable for naturally ventilated houses. The challenge for designers is to produce a comfortable built environment that is sustainable in terms of minimizing energy consumption. This study uses the UK Climate Change Projections to assess the current thermal comfort models and identify their effectiveness in dealing with conditions predicted for the years 2020, 2050 and 2080. A typical wall system is tested under conditions predicted for London, UK. This process focuses on reducing energy consumption and improving indoor air quality on the basis of thermal neutrality models. Among the passive options tested, the research found that high-density insulation in addition to shading devices could be effective design solutions to minimize the extreme effects of climate change, although none could completely provide a full year comfort zone, particularly by the 2080's.

Keywords

Thermal Comfort, Indoor air quality, sustainability

Introduction

The five traditional methods of human perception give neutral pieces of information. Thermal sense is not recognized within those and mainly the difference is that this sense is never neutral; it is actually imitating what the body is experiencing. This sense can tell adapting time of the body to heat loss or gain but cannot read the temperature. Hensen (1991) defined thermal comfort, as “a state in which there are no driving impulses to correct the environment by the behavior”. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) also defined it as “the condition of the mind in which satisfaction is expressed with the thermal environment” (ASHRAE, 2004).

Satisfaction is associated with thermal sensation of “neutral” or slightly warm or cool. To clarify the matter, the search for acceptability explain the goal of pursuing thermal comfort for buildings' occupants more clearly. On a similar vein, ASHRAE (1992) mentioned that “thermal environmental conditions for human occupancy, is to specify the combinations of indoor space environment and personal factors that will produce thermal environmental conditions acceptable to 80% or more of the occupants within a space”.

Background

A number of studies focused on the impact of climate change on the built environment utilizing sophisticated simulation tools to make hour-by-hour computation of the heating/cooling loads. Building energy simulation is a satisfactory technique to estimate temperature by dynamic interactions between the outside climate, the building envelope and the internal heating and cooling system. This technique has also been used by a number of researchers to evaluate climate change effect on energy use in buildings. De Wilde et al (2010) considered the uncertainties in the impact of climate change prediction on the thermal performance of buildings. For a terraced house, the uncertainty is enormous, at 60% or more. Similarly, Collins et al. (2010) assessed the impact of climate change on the future energy consumption in the UK housing stock at four weather data locations: Cardiff, Edinburgh, London and Manchester.

Approximately 2.3 million houses in England are now anticipated to be in fuel poverty, and it seems with growing energy cost, more households will be subject to fuel poverty (Moore, 2005). A household in fuel poverty is assumed to be one with a fuel bill more than 10% of income to maintain satisfactory thermal comfort. Basically, fuel poverty is a result of high-energy cost, low income and energy inefficient dwellings. With consequent increased health risk and poor quality of life from continued exposure to cold and hot temperatures (Wilkinson, Landon, Armstrong, Stevenson, & McKee, 2001).

Methodology

This paper assesses a range of thermal comfort definitions and assessment tools and highlights the effectiveness of each method. A simple model is utilized for quantification purposes and uses the Design Builder simulation tool and future climate scenarios for 2020, 2050 and 2080 in order to evaluate indoor temperature with regard to thermal comfort definitions. Insulation and shading devices have been chosen to decrease the risk of overheating and overcooling.

Thermal comfort

The clarification of an acceptable thermal comfort for occupants is important to the success of a building, not only because of the air quality, but also because it will decide a building's energy consumption and consequently has impacts on its sustainability. Therefore, specific thermal comfort standards are essential to assist building designers to provide an indoor climate which will be found thermally comfortable by occupants.

Thermal comfort is closely associated with the thermal balance of the body. This balance is influenced by two major categories of variables (CIBSE, 2006):

- 1) Environmental parameters including:
 - Mean Radiant Temperature (MRT)
 - Air Temperature (AT)
 - Relative air velocity (Vel)
 - Relative Humidity (RH)
- 2) Personal parameters including:
 - Activity level (Act)

- Clothing level (Clo)

Thermal comfort approaches

Currently, two sorts of approaches for the definition of thermal comfort exist: the rational or heat-balance approach and the adaptive approach. The heat-balance approach uses data from climate chamber studies, best illustrated by the Fanger's model while the adaptive approach is based on the field studies of occupants in building.

Heat balance approach

The most well known method, in this category is "Predicted Mean Vote" (PMV) and "Predicted Percentage of Dissatisfied" (PPD) model proposed by Fanger which combines the impacts of theories of heat balance with the physiology of thermoregulation factors into an specific value on a thermal sensation scale which has been accepted widely (Fanger P. , 1972). Figure 1 below shows the relationship between PMV and PPD in the Fanger model.

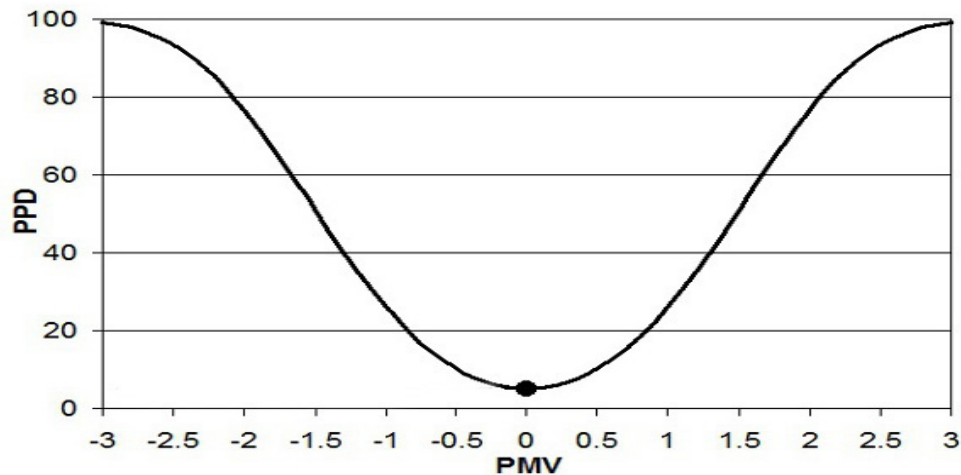


Figure1: Relationship between PMV and PPD, Source:
<http://www.intechopen.com/books/air-quality/a-review-of-general-and-local-thermal-comfort-models-for-controlling-indoor-ambiences->

According to Fanger's theory, our body employs physiological processes such as sweating and shivering to keep a balance between the heat gains and losses. However, Fanger highlighted that "man's thermo-regulatory system is quite effective and will therefore create heat balance within wide limits of the environmental variables, even if comfort does not exist" (Fanger P. , 1970). The Fanger's model on thermal comfort was a ground-breaking contribution to the evaluation of indoor thermal environments as well as to the theory of thermal comfort. It is generally accepted and used for the assessment of thermal comfort (ibid).

Adaptive approach

Fanger's model has come to be regarded as applicable across wide range of building types, populations and climate zones (Parsons, 1994). But this approach has been

challenged by many researchers arguing that his model ignores significant cultural, social, climatic and contextual dimensions of comfort, leading to an exaggeration of the demand for air conditioning (De Dear & Brager, 1998). Therefore, as it can be seen in the figure 2, although the Fanger's model shows reasonable accuracy in most air-conditioned buildings, failed considerably in the naturally ventilated buildings. Significant failures in results for naturally ventilated buildings and rising dissatisfaction with static comfort temperatures has driven interest in a variable indoor temperature standards. Basically, in these buildings, a variable indoor temperature standard, based on the adaptive model of thermal comfort, would have more particular relevance rather than static models. An adaptive standard links thermal comfort to the climatic context of the building and considers past thermal experiences as well as occupants' current thermal expectations. Past thermal history and contextual factors are assumed to modify thermal preferences and expectations (De Dear & Brager, 1998).

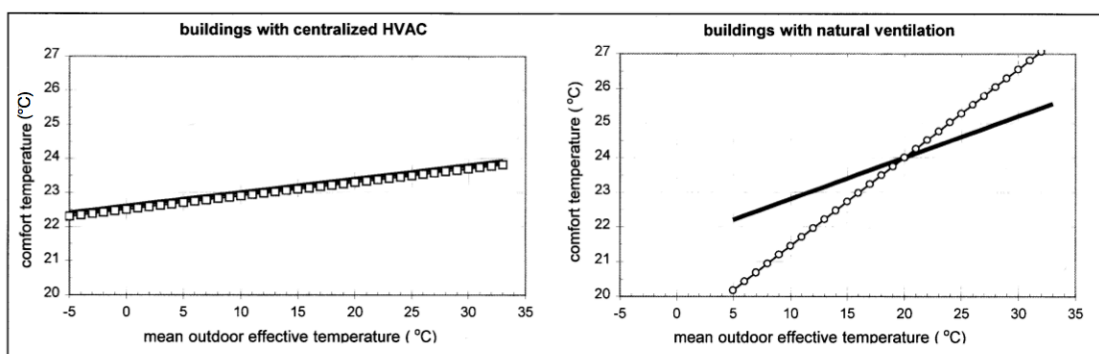


Figure 2: mean outdoor effective temperature in centralized HVAC and natural ventilation, Source: (De Dear & Brager, 1998)

In essence, the adaptation term could be assumed broadly as the gradual reduction of the organism's response to frequent environmental stimulation. Within this comprehensive definition, it is feasible to distinctly classify three categories of thermal adaptation including behavioral, physiological and psychological adjustment. Behavioral adjustment could be further classified into technological (such as turning on/off cooling or heating systems), personal responses (such as removing or wearing clothes) and cultural responses (such as having a siesta). In fact, unconsciously or consciously these modifications are totally specific responses for thermal comfort. Physiological adjustment includes any changes in the physiological responses that might result from thermal environmental factors exposure, and would cause a gradual adaption by such exposure. Physiological adaptation can be classified into genetic adaptation and acclimatization. Psychological adjustment refers to a reaction to and perception of physical information related to expectations and past experiences (Clark & Edholm, 1985).

In adaptive models, in fact, it is the interaction between occupants and the building or any other environment that determines comfort temperature. Clearly, climate is the major contextual variable. Climate is a main effect on the psychological, physiological and behavioral adjustment of people and thus, on the design of the buildings. Although, climate may not change the fundamental mechanisms of the human interaction with the thermal environment, a number of detailed ways exist in which people are subject to stimuli, and these play an increasing role in peoples'

reaction to the indoor climate.

Building as the second major contextual factor in determining comfort plays a part through its services. Time is the third contextual parameter. This indicates that the comfort temperature is repeatedly fluctuating. The magnitude of these fluctuations and their rate at which they occur is a significant concern (Nicol and Humphreys 2002)

Climate change and uncertainty quantification

Nicol and Roaf (1996) suggested the Eq. (1) model for occupants of naturally ventilated buildings. Other adaptive models have also been suggested such as Humphreys models for neutral temperature, as given by Eq (2) and (3) (Humphreys MA, 1976). Auliciems and de Dear established relations for calculating group neutralities on the basis of mean indoor and outdoor temperatures, as shown in Eqs. (4), (5) and (6), which were recommended by ASHRAE in Eq. (8) (ASHRAE, 2004).

$$T_{n,o} = 17 + 0.38T_o \quad (1)$$

$$T_{n,i} = 2.6 + 0.831T_i \quad (2)$$

$$T_{n,o} = 11.9 + 0.534T_o \quad (3)$$

$$T_{n,i} = 5.41 + 0.731T_i \quad (4)$$

$$T_{n,o} = 17.6 + 0.31T_o \quad (5)$$

$$T_{n,i,o} = 9.22 + 0.48T_i + 0.14T_o \quad (6)$$

$$T_c = 17.8 + 0.31T_o \quad (7)$$

In equation above, T_c is the comfort temperature, T_o is the outdoor air temperature, T_i is the mean indoor air temperature, $T_{n,i}$ is the neutral temperature on the basis of mean indoor air temperature, and $T_{n,o}$ is the neutral temperature on the basis of the mean outdoor air temperature. CIBSE (2006) recommended comfort temperature based on common environmental and physiological factors shown in table 1.

Table 1: Recommended comfort temperature range for dwelling based on common environmental and physiological factors, source: (Taranto Rodrigues, 2009)

Dwelling Zone	Activity (met)	Clothing Winter/ Summer (clo)	Suggested Air Supply Rate (l/s/person or ach)	Winter Operative Temperature (°C)	Summer Operative Temperature (°C)
Bathroom	1.2	0.25	15	20-22	23-25
Bedroom	0.9	2.5/1.2	0.4-1ach	17-19	23-25 (26)
Circulation	1.8	0.75/0.65	-	19-24	21-25
Kitchen	1.6	1.0/0.65	60	17-19	21-23
Living Room	1.1	1.0/0.65	0.4-1ach	22-23	23-25 (28)
Toilet	1.4	1.0/0.65	>5ach	19-21	21-23

It can be understood from the table above than a temperature range of 18-26 is highly likely to be within comfort area. Moreover, ASHRAE 55-2004, clarified

thermal comfort as a subjective response and is defined as the ‘state of mind that expresses satisfaction with existing environment’ (Brager & de Dear, 1998). It can be observed by this definition that a specific value cannot be assigned to thermal comfort. “State of mind” generally depends on occupants’ perception and expectation. However, ASHRAE-55 is based on the static heat balance and is based on of four environmental variables, i.e. temperature, mean radiant temperature, relative humidity and air velocity as well as activity and clothing level of the occupants. This includes PMV/PPD calculation methods and the concept of adaption (Figure 3). Therefore, this paper uses this standard for quantification purposes and simplification of decision-making.

A simple model with High, Low and shading device tested in Design builder with 2011,2020,2050 and 2080 climate data to observe total discomfort hours in each category as shown in figure 4.

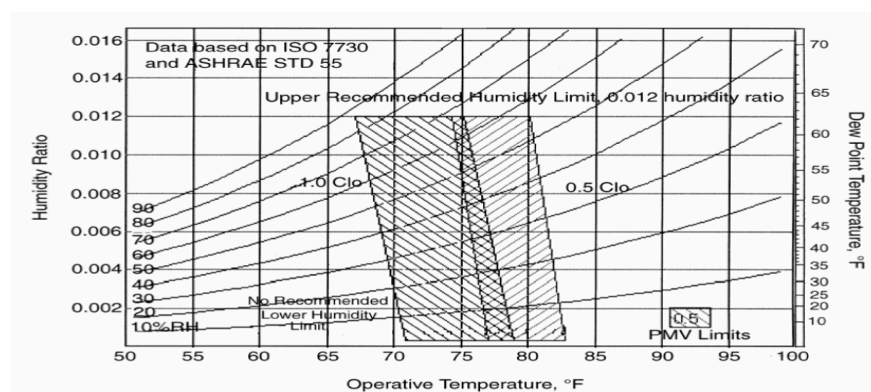


Figure 3: ASHRAE comfort zone, source: (Brager & de Dear, 1998)

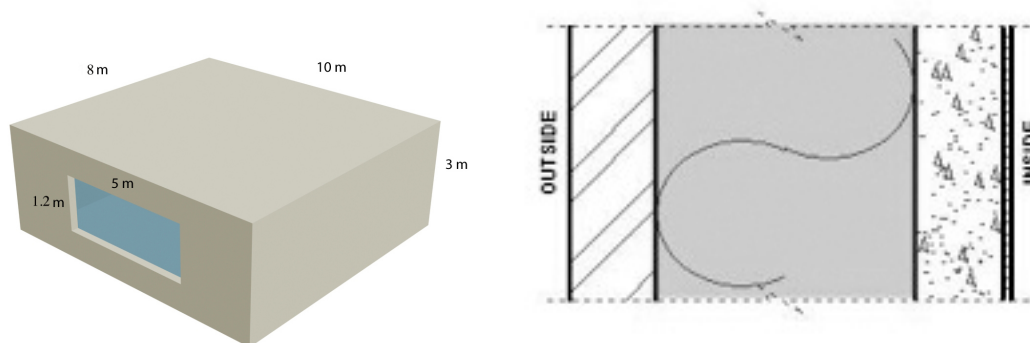


Figure 4: model under calculation, Brick and block Construction System

It can be noticed from graph and figure above that increasing temperature will cause more discomfort hours and neither high insulation nor shading device can reduce total discomfort hours, Although 1m shading device effectively performs better than high insulation after 2020. Not that much differences between high and low insulation observed from 2020. Increasing the thickness of insulation would cause higher u-value and increasing total discomfort hours might be more overheating than overcooling in 2080.

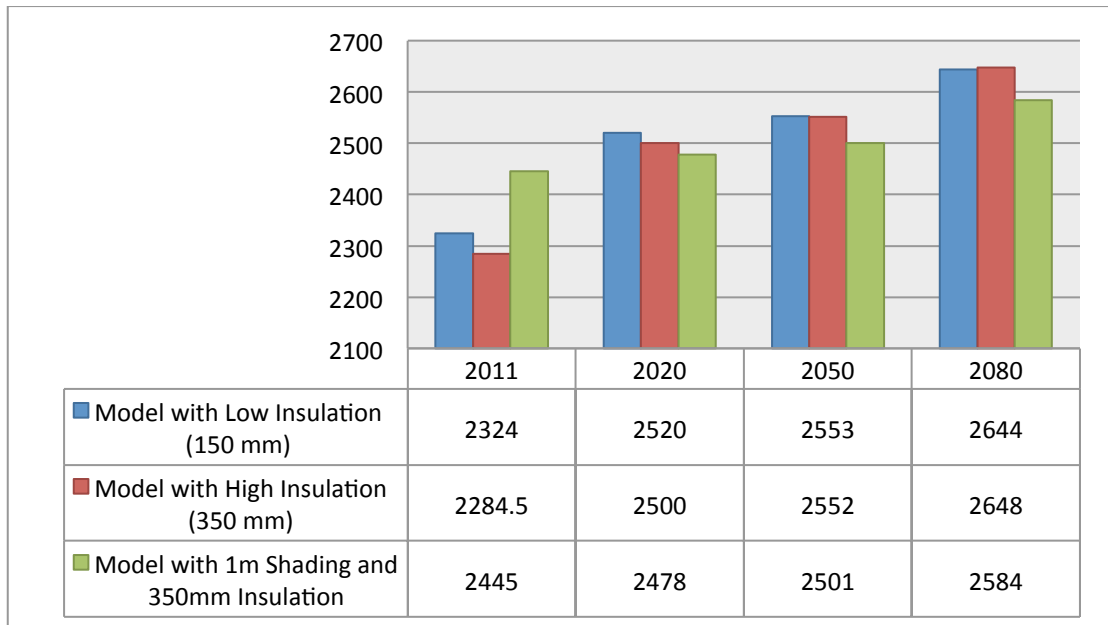


Figure 5: Total discomfort hours in London

Conclusion

The current standards, which mainly describe human thermal comfort conditions, appear to be an essential factor in the building sustainability determination. From the range of criticisms and uncertainties involved, however, a definite value cannot be employed to thermal comfort. State of mind is generally determined by expectation and perception of the occupants. Therefore, different persons may perceive the similar thermal environment differently or different persons may perceive the similar thermal comfort level at different thermal environments. In essence, the question is, how can thermal comfort standards play a role in facilitating the appropriate use of energy-efficient, climate-responsive building design strategies? Clearly, more integrative view of the indoor environment is needed. Most analyses look at one result at a time, and try to evaluate the ideal environmental conditions for thermal comfort optimization, energy consumption or indoor air quality (comfort).

In order to clarify the objectives for thermal comfort environment, it is better to define whether slightly warmer or cooler situation could still be considered in the range of acceptability in the existing standards. The answer may depend on context whether the priority is to optimize comfort or energy reduction. However, passive design strategies in tested model shows that discomfort hours could be reduced significantly by using shading device and high insulation, but depends highly on the period of occupation assumed.

Further research and development work

It is generally believed that our climate is changing and the thermal and energy performance of buildings will be affected. Architects and building engineers can no longer assume a constant static condition for their designs, and need to consider the values of design variables for future years. Also, a reduction in heating energy use and an increase in cooling requirement would result in a shift towards more demand for electrical power. The issue of carbon footprint of fuel mix and the role of

renewable energy need to be addressed.

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Investigating Psychological Variables as a Means for Attitude Change towards Sustainable Development

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Abstract

A built environment is necessary for humans to live, work and socialise. Construction activities however have a detrimental impact on the environment. Despite many government initiatives and policy drives, implementation of sustainable practices within the construction industry remains slow. Attitudes have been shown to preclude implementation of such practices. Attitudes towards environmental issues have been widely researched, however research into attitudes towards the environmental, social and economic dimensions of sustainability within the built environment are virtually non-existent. To this end a tool to measure such attitudes was developed and piloted amongst built environment students. Psychological assessment was conducted to investigate whether psychological constructs mediated student attitudes. The results of the piloted study indicated that emotional self-efficacy and optimism correlated with different subscales of the attitude questionnaire but that only emotional self-efficacy correlated with the questionnaire overall. Directions for future work in this research are outlined in relation to further validation of the measure and further analysis of the psychological variables.

Keywords

Attitudes, Psychology, Psychometrics, Scale Development, Sustainable Development

Introduction

Sustainable development (SD) is a topic that has gained much attention over the last 30 years however, despite an increasing number of studies highlighting the importance of sustainability in construction projects (Medineckiene *et al.*, 2010), progress towards the same within the construction industry is slow compared to other industries. Much has been written on the need to embed sustainability and SD into higher education (HE) curricular (Murray, 2011) so that graduates on entering the construction industry are equipped with the skills and knowledge to adopt sustainable practices however, integration has been slow (Bossellmann, 2001; Everett, 2008; Rode & Michelsen, 2008) and is therefore not filtering into industry quick enough if at all. It has long been recognised that providing environmental education provides people with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to investigate issues, solve problems, protect and improve the environment (UNESCO, 1977) an opportunity which

appears to be lacking at present within the construction industry. In addition, whilst HE has been used as a vehicle for promoting environmental change, attitudes of students in this area are highly under researched (Kagawa 2007; Drayson *et al.*, 2012) and thus it is not yet evident if sustainability education they are receiving is having an impact. Given the construction industry is responsible for 50% of all worldwide energy usage (a major contributor to climate change) and many of its practices have a detrimental impact on the environment, this is a matter which needs urgent attention. Most environmental degradation and destruction is caused by human behaviour and as such, knowledge regarding what predisposes people to behave sustainably is required (Corral-Verdugo *et al.*, 2010). Psychology, the scientific field for the study of behaviour can provide us with such knowledge and may thus play an important role in the field of SD. There has been a growing interest in studying SD from a psychological perspective particularly in relation to sustainable behaviour. The field of Environmental Psychology is not a new concept, however pertaining to SD it is relatively young area of research and one which looks very promising for moving the sustainability agenda along. Indeed as Corral-Verdugo *et al.*, (2010) state “The elucidation of the psychological dimensions of sustainability is a primordial step in designing interventional strategies aimed at encouraging people to behave in accordance with sustainability principles”(p7). This statement underpins the very premise and aim of the current research.

The aim of this paper is to investigate whether relationships exist between psychological variables and attitudes towards sustainable development. To achieve this aim, a pilot study measuring attitudes towards sustainable development, optimism and emotional self-efficacy was conducted and the results correlated. Results yielded from the outcomes of the study are to be used to inform the development of educational interventions which if successful, could be important for embedding sustainability literacy in continuing professional development (CPD) and/or training programmes within industry.

Sustainable Development and the Construction Industry

The terms sustainability and SD have become synonymous with the construction industry in recent years with many sustainability issues highlighted within the field of the built environment now debated and explored around the globe (Yang *et al.*, 2005). The most widely adopted and cited definition of sustainable development is that from the Brundtland Report from the World Commission on Environment and Development (WCED) “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). Since the Brundtland report and subsequent definition, the concept of sustainable development has evolved significantly from that of ‘being green’ and reducing the consumption of natural resources and recycling (Yang *et al.*, 2005) to a broader concept which incorporates social and economic aspects as well as environmental. These aspects have come to widely known as the three pillars of sustainable development (Figure 1).

In the past, industry has tended to focus on the economic dimension, concentrating more on short-term gains and reporting quarterly figures rather than looking at what they can achieve in the long term thus providing for now without consideration for future generations which is not in line with sustainable thinking (Dyllick & Hockarts, 2002). As can be seen from figure 1, true sustainability can only be achieved when all three of the dimensions are considered holistically. The

construction industry is renowned for being resistant to change however which can be attributed as the main reason for not implementing sustainable strategies (Lingard, *et al.*, 2000; Yang *et al.*, 2005). The recent Wolstenholme report ‘Never Waste a Good Crisis’ (Wolstenholme *et al.*, 2009) states that it is no longer about whether sustainability is the right thing to do but what stops industry doing it. (p5). A growing number of reports in the literature have investigated this and have identified that a number of barriers, including cost and a lack of knowledge preclude implementation allowing the status quo to remain.

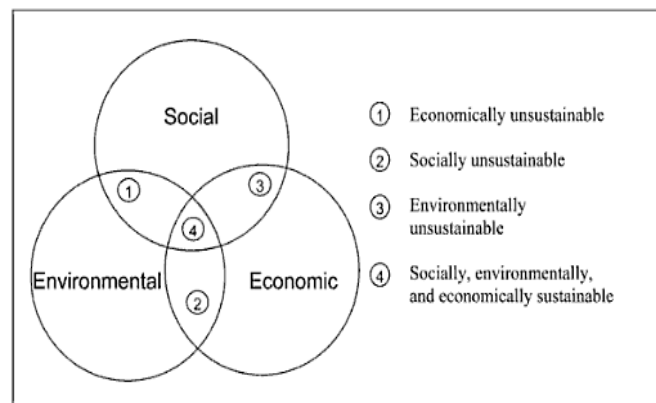


Figure 1. Dimensions of Sustainability (From Larsen, 2009)

Educating Construction Professionals

There has been a growing development of education for SD (ESD) with a great deal written about the need to embed sustainability within HE over the last decade (Fien, 2002; Boyle, 2004; Lordel *et al.*, 2005). In addition, the UK government have an on-going commitment to promoting ESD which is emphasised in the UK's official SD strategy, which asks educators “to make sustainability literacy a core competency for professional graduates” (HMG, 2005, p39). The UN declared 2005-2015 the “Decade for Education for Sustainable Development” (UNESCO, 2003). Haigh (2005) states that the decade: . . . offers academics the best chance to date for making the deep and radical changes that will be necessary if the world's HEIs are to enact their responsibilities for creating a better and self-sustainable world” (p32). What is lacking here however is an emphasis on industry itself particularly given that (re)education of construction professionals has been identified as a barrier towards sustainability (Chan *et al.*, 2002).

However, whilst there is no doubt regarding the necessity for ESD, debates over the years have questioned whether environmental education can be regarded as successful, when and if it produces changes in people's knowledge but not in their actions (Beck 1995, 1997; Lenzen 1997; Tilbury 1995; Tilbury & Cooke 2005: cited in Kemmis & Mutton, 2012). Given that the requirement now is to move from rhetoric to action, something more than education is needed. Adopting an interdisciplinary approach which seeks to investigate psychological variables that may mediate attitudes and thus behaviour change is therefore a promising avenue of exploration.

Psychology and the Built Environment – An Interdisciplinary Approach

The literature indicates that emotional intelligence (EI) may be a useful construct in relation to sustainability and attitude change. Taylor (2007) in a study on emergent leaders who act as change agents to promote sustainable urban water management conducted a review of the literature review on the same and found that sustainable urban water management champions are likely to have distinctive personality characteristics including high levels of EI. Boyatzis (2009) also found that emotional, social and cognitive intelligence competencies predicted effectiveness in professional, management and leadership roles in many sectors of society and state that in addition, these competencies can be ‘developed’ in adults. Scholars tend to view EI as a factor which has the potential to contribute to more positive attitudes, behaviours and outcomes (Carmeli, 2003). The recent development of the emotional self-efficacy scale (ESES, Kirk *et al.*, 2008) demonstrated that high emotional self-efficacy was associated with greater dispositional emotional intelligence and it is this scale that is used in the current study. If results from the current study find that those with higher levels of EI have greater positive attitudes towards sustainability, the same may reveal ways of targeting attitude change in educational interventions.

Another construct which looks promising is Optimism. Optimism is an individual difference variable that reflects the extent to which people hold generalized favourable expectancies for their future (Carver *et al.*, 2010). A number of psychologists have documented the diverse benefits of optimism and drawbacks of pessimism (Peterson, 2000). Some authors (e.g. Doppelt, 2008) postulate that a positive orientation (optimism) is important for sustainability in that people are more likely to succeed in identifying ways of overcoming obstacles, if they hold an optimistic orientation. Authors such as Corral-Verdugo and Pinheiro (2006), and Joreiman, *et al.*, (2001) have found that future-oriented individuals are also pro-environmentally oriented individuals. Corral-Verdugo *et al.*, (2009) contend that being future-oriented may imply also being attracted by factors supporting the long-lasting life of the socio-ecological systems. Ample research (Seligman, 1990) has shown that people can adopt an optimistic orientation if they choose to do so. The concepts of optimism and pessimism have ties to psychological theories of motivation, known as expectancy-value theories. These theories suggest a logical basis for some of the ways in which optimism and pessimism influence people’s behaviour and emotions (Carver *et al.*, 2010). This and the fact that sustainability is very much a future orientated concept make it a worthwhile area of research for the present study. The current study used the LOT (Life Orientation Test, Scheier & Carver, 1985) to assess optimism amongst individuals. The LOT was developed to assess individual differences in generalized optimism versus pessimism. The LOT is a 12-item measure of optimism versus pessimism. Of the 12 items, 4 items measure optimism, 4 items measure pessimism, and 4 items serve as fillers. For the purposes of the present research the fillers were taken reducing the scale to 8 items to avoid boredom affects given the number of questionnaires to be given to students.

Pilot Study

The aim of this paper was to assess attitudes towards SD amongst built environment students and whether the psychological constructs optimism and emotional self efficacy mediate these attitudes. Based on the existing literature, it was hypothesised that:-

1. Students who score highly on the LOT would have higher scores on the attitude scale.
2. Students who score highly on the ESES would have higher scores on the attitude scale.

A thorough literature review identified that whilst a number of instruments exist which measure environmental attitudes, no instruments exist which measure attitudes towards the other domains of SD, namely the social and economic aspects. It is well documented in the literature that sustainability cannot be achieved unless all three are taken into account thus the first step was to develop such a measure.

Development of the Sustainable Development Attitudes Measure (SDAM)

Attitudes are a latent construct and cannot be observed directly (Milfont & Duckitt, 2010). Thus, rather than being measured directly, attitudes have to be inferred from overt responses (Himmelfarb, 1993). Methods of attitude measurement can be broadly organized into direct self-report methods (such as questionnaires/interviews) and implicit measurement techniques (Krosnick, *et al.*, 2005). For the purposes of the current research a questionnaire approach was deemed the best method to capture the data required.

In order to ensure a strong theoretical grounding, items were developed from the literature and existing measures. A total of 70 items were pooled and placed into subscales representing the three dimensions of sustainability (environmental, social and economic). A fourth scale 'other' was created to encompass important political and educational issues pertaining to SD.

Scale Response

When measuring attitudes, Likert-type scales are most commonly used which measure levels of agreement/disagreement. Such scales assume that the strength/intensity of experience is linear, i.e. on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured. Respondents may be offered a choice of five to seven or even nine pre-coded responses with the neutral point being neither agree nor disagree (Ratray & Jones, 2007). A 5 point Likert scale was chosen for the current scale. Whilst it is not ideal for respondents to answer neither agree or disagree, if this option is removed it can force respondents to choose a response, which may lead to respondent irritation and increase non-response bias (Burns & Grove, 1997 cited in Ratray & Jones, 2007) and as such this response option was left in.

Sampling

When piloting a questionnaire, a sample size of 300 is generally is deemed best however sample sizes of 200 plus are acceptable (Ratray & Jones, 2007). The SDAM was piloted to 230 built environment students along with the LOT and the ESES through purposive opportunity sampling. 6 of the questionnaires had to be omitted due to too many incomplete items or entire scales not being completed leaving a total of 224. Unfortunately the demographic section was only partially or not completed at all in some cases and so figures for age and gender are not accurate. Descriptive statistics indicate that of those who did complete demographics, 176 were male and 29 female (n205) with ages ranging from 18 to 48 and a mean age of 23 years (S.D 5.7, n168). Participants were instructed prior to

completing the measures that it was important if possible to avoid ticking middle boxes and that if they were veering towards a more negative or positive response to tick boxes demonstrating this.

Validation of the SDAM

A good questionnaire must have good validity and good reliability. Validity is concerned with the extent to which an instrument measures what it is intended to measure (Tavakol *et al.*, 2008; Bryman & Cramer 2001). Reliability is concerned with the ability of an instrument to measure consistently (Tavakol *et al.*, 2008). The SDAM was put through rigorous statistical and non statistical procedures in order to ensure a robust measure was created. These processes and outcomes are reported below.

Content validity

Content validity is a non-statistical type of validity that involves "the systematic examination of the test content to determine whether it covers a representative sample of the domain to be measured" (Anastasi & Urbina, 1997, p114). In order to ensure content validity, only items that were deemed to be relevant to sustainable development were considered. Content validity is usually conducted via a panel of experts in the domain being investigated (Rattray & Jones, 2007). As such, the list was emailed to 10 experts, 5 from LJMU and 5 professionals in industry currently undertaking the MA in Sustainability at LJMU. Experts were asked to assess the content, relevance and clarity of the statements and provide their comments on the same. In addition they were asked to rate the item on a scale of 1-5 with 1 being weak and 5 being strong.

The 70 questions were then whittled down to 28 based on the ratings, feedback and comments for each item. To ensure students were engaging with the questionnaire and not just 'ticking boxes', three of the statements were given an opposing statement. These were statement numbers 3/15, 6/21 and 12/23. Items 18, 24, and 28 were negatively phrased and reverse scored in an effort to reduce response bias.

Inter-item Correlations

Items should inter-correlate at a significant level if they are measuring aspects of the same thing, in this case sustainable development. Any items that do not correlate at a 5% or 1% significance level should be excluded. Correlations for the SDAM revealed that all individual items correlate significantly with each other as do the subscales. Correlations for the subscales are reported here only (table 1).

Table1. Correlations between subscales of the SDAM

	Social Subscale	Economic Subscale	Other Subscale	Environmental Subscale
Social Subscale	1	.483**	.681**	.544**
Economic Subscale	.483**	1	.478**	.348**
Other Subscale	.681**	.478**	1	.453**
Environmental Subscale	.544**	.348**	.453**	1

*correlation is significant at <0.05 level **correlation is significant at <0.01 level (two-tailed)

Reliability

An important aspect of a psychometrically developed measure is the reliability of the scale and its subscales. Chronbach's alpha is used to test for internal consistency of scales. Different authors have differing views on what are acceptable alpha levels for measures. Bryman & Cramer (2001) posit that if items show good internal consistency, Cronbach's alpha should exceed .7 for a developing questionnaire and .8 for a more established questionnaire. Hair and Anderson (2010) however posit that for exploratory research, levels of .6 are acceptable.

Reliability for the SDAM was .86 overall indicating that the scale has excellent reliability for an exploratory measure. Alpha scores for the subscales were all acceptable except the economic subscale which was below the acceptable level required (.529). Item total statistics indicated that if item 10 was dropped this would bring the subscale to a reliable level of .611 (in addition increasing the overall reliability of the SDAM from .86 to .87). All final reliabilities, means and standard deviations are provided in Table 2. The mean score for the SDAM total 99.54 was with a standard deviation of 13.28 indicating a good variance across responses.

Correlations for SDAM, LOT and ESES

As the purpose of this research is to investigate whether psychological traits mediate attitudes towards SD, the next step was to see whether the SDAM correlated with either of the psychological constructs as hypothesised. The SDAM correlated with the ESES but not the LOT. This is somewhat surprising for the LOT given the 'future orientation' link with sustainability. Further analysis indicated that the LOT correlated with the economic and the other subscales however, and that despite the ESES correlating overall with the SDAM it correlated with the other and social subscales only. As such hypothesis 1 was rejected and hypotheses 2 accepted.

Table 2. Reliability Coefficients for the SDAM and subscales with Means and Standard Deviations

	Chronbach's Alpha (α)	Mean	SD
SDAM Total	.87	99.54	13.28
Environmental Subscale	.604	25.01	4.08
Social Subscale	.738	26.59	4.32
Economic Subscale	.611	20.14	3.80
Other Subscale	.788	27.29	4.59

Table 3. Correlations for the LOT and ESES with the SDAM and its subscales

	SDAM	Environment	Social	Economic	Other
LOT	.108	-.055	.094	.160**	.144*
ESES	.120*	-.031	.141*	.109	.153*

*correlation is significant at <0.05 level **correlation is significant at <0.01 level (one -tailed)

Conclusions

Given this was an exploratory approach to understanding attitudes towards sustainable development, it is hard to decipher exactly why the LOT did not correlate with the SDAM. One explanation may be that people may hold positive orientations for their own future but that this does not extend to the future of humanity. The correlation however is not far off from being statistically significant at .053 with levels of <.050 statistically significant. The ESES did correlate overall with the SDAM, however again it correlated with two of the subscales only. The fact that some of the subscales correlated indicate that these measures are associated and worthy of more elaborate analysis, particularly the other' subscale as it correlated with both the LOT and ESES.

The finding that the economic subscale had the lowest reliability and lowest mean indicated that attitudes towards this subscale were less favourable than the others. One explanation for this may be that as attitudes are formed as a result of our knowledge and experiences (Murray, 2011), given the pilot was with students, it may be that they couldn't relate to this aspect of SD as they have no experience of the same. Industry professionals however will and it this reasoning that lead to the rationale for keeping the subscale as it is. In addition, whilst it could be argued that the sampling population was a limitation, Shepherd *et al.*, (2009) in developing a questionnaire looking at sustainable values noted that using student samples was permissible when looking at psychological phenomena.

The main limitation of the study was that data was only conducted at one time point. No test re-test reliability analyses were conducted to assess whether the SDAM holds internal consistency over time. This is not a major issue at this stage in this research however as it is a process which can be addressed later on. The high reliability of the SDAM will allow for distribution amongst a wider population and will contribute to further validating the measure. As hypotheses 1 had to be rejected, analyses of other psychological variables not included in this study will be conducted to investigate their possibility of eliciting attitude change. A study by Amel *et al.*, (2009) found that acting with awareness, a facet of mindfulness was significantly positively correlated with self-reported sustainable behaviour highlighting it as a promising area for investigation.

Further statistical investigation as well as a further review of the literature is needed and shall form the basis of the next stage of this research. The sample size for the pilot was sufficient enough to allow for factor analysis (FA) and structural equation modelling (SEM) to be performed to assess the quality of individual items and explore further the relationship between aspects of the SDAM, LOT and ESES.

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Poster Presentations

Achieving higher transparent PhotoVoltaic panel output and high performance cool roofs through system integration

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Abstract

In this study, the effects of a cool/reflective roof and a green roof on transparent Photovoltaic panels (Polysolar PS-C series a-Si transparent module) are observed in a real world test environment. It is hypothesized that the high reflective roof surface (ALKORBRIGHT) will increase the performance of the PV panel, using the roof surface to reflect more light back into the rear of the panel. This also aims to address orientation issues, with the surface being able to reflect light into the panel from a multitude of angles. The second test roof, will use another identical PV positioned over a green roof (Blackdown NatureMat system) so that the performance of both elements can be analysed. It is hypothesised here, that the localised cooling effect of the green roof, coupled with some degree of solar reflectance will also improve the performance of the PV. Ultimately, it is to be tested later in the study if the panels themselves can be used to create a greenhouse effect over the green roof to create a micro climate for the green roof to utilise. The PV's effect of providing partial shading to the green roof will also be analysed. Real world testing as a pose to Standard Condition Testing is much more important for a-Si modules, performing differently to c-Si modules in a way that is much more suited to the UK climate (lower ambient light operating levels, reduced heat fluctuation vulnerability), this coupled with their much cheaper production cost and increased applicability justifies the development and testing of these types of panels. It is the aim of this study to counteract the lower 'stand alone' efficiency of a-Si, by combing them with other sustainable/renewable technologies to further develop their potential as a cost effective, sustainable, and efficient building envelope technology.

Keywords

Photovoltaics, transparent, Green Roofs, Cool Roofs, solar technology, system integration

Issues of Market Orientation to be Handled in Saudi Construction Industry

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Abstract

Following the oil boom that made massive wealth for the country in the last decade, Saudi Arabia started developing non-oil-manufacturing industries like construction and real estate. In 2011, Saudi Arabia had the second highest real estate and construction project value in the GCC (Gulf Cooperation Council), worth £136.2 billion, constituting 35.0% of the total construction and real estate projects. Most of these projects are being executed by Saudi construction companies. An observation of the Saudi construction environment supports considering a relationship between a market orientation and the performance of these companies. In fact, companies are increasingly realizing the usefulness of marketing in winning customer responses. Hence, given today's highly competitive business environment, market orientation is essential for the survival of any company. Furthermore, several studies show a strong positive relationship between a market orientation and organizational performance and a number of attempts to assess a market orientation in different industries around the world has been made. However, very few attempts have taken place in the context of Saudi Arabia. The aim of this paper is to examine the applicability of this model in Saudi Arabian construction industry and to discuss five adopted antecedents to a market orientation, which are related to top management characteristics, organizational systems, and interdepartmental dynamics.

Keywords

Market Orientation, Saudi Arabia, Construction Industry

Rising damp in domestic houses: a quasi-experimental case study to evaluate methods of moisture measurement

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Abstract

An investigation is planned of the ground floor walls of a house affected by rising damp. The aim of this project is to evaluate the effect of remedial damp proofing systems in a real world situation and to determine if there is correlation between moisture in the walls and vapour pressure in the dwelling. To satisfy these two aims the project needs a reliable method of monitoring the rate of moisture change within the walls and the surrounding environment. This paper describes the findings of a sixteen month study to test the effectiveness and suitability of various moisture measurement techniques. The study employed a quasi-experimental methodology and required the construction of an apparatus to enable the test wall—the ground floor wall of a brick-built Victorian house—to be wetted and later dried. Hygrometer sensors and various types of timber probes were embedded in the wall and an electronic meter used to take periodic readings from this equipment, the wall face, and the underlying construction. The findings revealed a range of performance: good from simple embedded timber probes; poor from humidity sensors; and mixed from the electronic moisture meter when used directly on masonry. In addition, although relative humidity is a function of temperature, the results indicated that temperature also influences the readings of other methods tested.

Keywords

Moisture measurement, relative humidity, rising damp, timber probes, vapour pressure

The Image of Accra: Streets of Significance in the Central Business District

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Abstract

Accra has been Ghana's capital city since 1877 when the colonial headquarters of the then Gold Coast was relocated from Cape Coast. It has seen growth and development over the decades and continues to change on a daily basis as buildings and physical infrastructure are constructed in an effort to modernize the city. With the changing physical environment, come constant changes in the mental image of the city held by its dwellers. This paper discusses the image of Accra, ascertaining its functional performance, visual quality and the built environmental quality. It will focus especially on one particular aspect of the elements that make up the image of a city, as propounded by Kevin Lynch. That is the paths, with specific attention to the streets, which are the major channels along which the citizens move as they form their public image of the city. The scope of the study will be limited to the Central Business District (CBD), which is the area of Accra bounded by the Ring Road and the coastline. With the aid of physical surveys, interviews and reviews of literature, the streets in the CBD will be categorized into civic, commercial, ceremonial and shopping streets. The respective strengths and weaknesses of the streets representing the various categories will be examined as well as the effects that their state have on the image formed and carried by the people. Recommendations will be made to improve the quality of these streets enhancing their liveability, imageability and sustainability.

Keywords

Accra, Central Business District, Streets, Sustainability, Visual Quality.

Innovation in Urban Transport; what is blocking the breakthrough technologies that will deliver a more sustainable future?

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Abstract

Inefficient use of energy, adverse health impacts and lost time through road congestion pose a challenge for all private modes of transport in our cities. The increasing number and scale of the Metro, Bus Rapid Transit and Light Rail systems in the larger cities around the world are a response to this, however, these solutions represent major capital investments creating a barrier to adoption for smaller conurbations. Modern tramways and streetcars can offer lower cost solutions but even these are only affordable to a narrow range of additional cities. Several innovations have emerged over the past 20 years which offer breakthrough contributions to the sustainable transport needs of smaller towns and cities, but most have yet to be implemented. This suggests that there is persistent failure in the process of bringing these solutions to market and that this process requires improvement. The research reported in this paper attempts to develop an understanding of the mechanisms that underlie this failure, particularly where this arises from the actions of the innovators themselves, and to use this to refine existing models of the innovation process. The key source of data for the research is a study of inventors and innovators and the trajectories of their innovations as they seek to achieve commercial success. Data will be gathered by interview from a broad group of innovators recruited from Inventors groups to establish a baseline of practical experience of the innovation process, in particular the interaction with others who supported or hindered the process. Basic psychometric data will also be gathered on the individual innovators to complement the descriptive data. This data can then be used to test the adequacy of current innovation process models to adequately represent those types of behaviour of inventors and innovators that adversely impact the successful commercialisation of an innovation. At this point it is proposed to set up an Action Learning Set with members drawn from the pool of innovators and inventors to develop, and validate an improved process model using a set of case studies drawn from the field of urban transport.

Keywords

Innovation process failure, inventor behaviour, improved process model, sustainability, urban transport

Implementing Innovation in Small Quantity Surveying Firms in Nigeria

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Abstract

The need for performance improvements in the construction industry today is as great as ever because clients continue to demand for better services particularly from consultants. For the professional quantity-surveying firm in the industry, the last decade has seen the emergence of innovative techniques in procurement like e-tendering, new methods of measurement, building information modeling, etc. Organizations in the construction industry are also devising new ways of managing organizational knowledge particularly the ones with tacit dimensions. Innovation in all facets of the industry has therefore been suggested as a way of realizing the step-change in performance improvement. Most innovation initiatives have been directed towards the big firms in the industry but, with the structure of the industry indicating a large number of operatives coming from the small firms sector, it makes strategic sense to consider how innovation is being carried out in small consulting firms. A research on this issue will deepen the existing sparse theoretical base of innovation in small firms and confirms the extent of performance improvement that innovation brings into small quantity-surveying firms. This research will investigate the process of innovation in small quantity-surveying firms in Nigeria. The nature of the research will be exploratory and will use several sources of evidence and data to be collected and analyzed from interviews, direct observation, questionnaires and documentation all geared towards answering the “how” and “why” questions. The research strategy will therefore be case study. Multiple case study is therefore proposed as the research method because there are identifiable cases of innovation in small quantity surveying firms in Nigeria. Four cases shall be studied in late 2013, two from the southern part and two from the northern part of the country. These cases will be decided based on the result of the questionnaire to be administered at the pilot stage in mid 2013.

Keywords

Innovation, small firms, quantity surveying, knowledge management, performance improvement

Design Development for Schools: an Investigation into the Process undertaken by England's Building Schools for the future (BSF) Programme

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Abstract

The researcher is heavily involved on a professional level with the procurement and delivery of schools' capital projects; in particular the Building Schools for the Future (BSF) programme. She is investigating the design development process undertaken within this programme, in order to assess whether it makes a successful contribution to well-designed schools, providing quality learning environments, which meet the requirements of those involved in this process, namely head teachers and teachers, local authority project management staff, architects and contractors. The research will achieve the following objectives: develop an understanding of those factors which contribute to the design development process, review critically the design development process undertaken during the BSF programme in order to identify its contributory components, evaluate the BSF design development process to determine whether the outcomes meet the requirements of key individuals, and identify good practice undertaken during the BSF design development process. The research will be undertaken via a literature review and case study and can be described as qualitative. An epistemological interpretivist approach is being followed and data collection is via interpretive, inductive methods, through the use of an in-depth investigative case study, focusing on two schools. Conclusions have been drawn from the literature review and from the initial findings from the empirical data, highlighting pedagogy, design theories, sustainability including environmental considerations, stakeholder participation and communications between architects and end users as the main factors influencing the design of school buildings. Government policy has informed and influenced these factors. The research is limited by the size of the case study and time restrictions. This research topic will ultimately lead to the formulation of recommendations for design development to be used by those employed on future schools' building projects. Design Development for Schools: an Investigation into the Process undertaken by England's Building Schools for the future (BSF) Programme.

Keywords

Schools, design, buildings, architects, communications.

Smart Sensor Network for Building Occupancy Detection

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Abstract

Significant energy is wasted servicing unoccupied buildings: in the UK for example, up to 23-30% of non-domestic service sector electricity demand can be from unoccupied lighting. Current occupancy sensing technologies may limit the effectiveness of buildings services, due to a number of issues ranging from unreliable data, sensor drift, privacy concerns, and insufficient commissioning. More effective control of heating, air-conditioning and ventilation (HVAC) as well as lighting systems may be possible using a smart sensing network for occupancy detection, capable of turning off services during unoccupied periods, thus enabling energy savings. We deploy a low-cost and non-intrusive sensor network in an open-plan office, combining information such as sound level, case temperature, carbon-dioxide and motion, to estimate occupancy numbers, while an infrared camera is implemented to establish ground truth occupancy levels. We use a genetic based search to select sensor data features that are highly correlated with occupancy while having low inter-correlation with other inputs, and then fuse selected multi-sensory features using machine learning techniques. From initial results, estimation accuracy reaching up to 85% was achieved during the testing period; and it was also shown that monitoring the case temperature of electrical appliances is an effective approach to establish usage patterns, from which occupancy can be inferred. The proposed system offers promising opportunities for improved energy efficiency in buildings, whilst also maintaining satisfactory indoor environmental conditions.

Keywords

Occupancy, features, sensor fusion, sensors, energy efficiency

Irish building regulation enforcement - a comparative study

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Abstract

This research forms part of a larger research process investigating the optimum structure for regulatory oversight of Irish building design and construction. Its aim is to compare the Irish structural mechanisms for inspections, approvals and certification of building regulation compliance with those operating in the UK jurisdictions of England, Wales, Scotland and Northern Ireland. Building Regulation reform has increasingly been on the political agenda in Ireland as quality and safety faults in buildings constructed during the recent economic boom have come to public attention. The follow-on case for increased regulatory oversight to better protect the public is being made while authorities and built environment practitioners in the UK are engaged in a process of regulatory simplification and rationalisation. These diverging tactics highlight the contradictory nature of the various regulatory objectives and outcomes. Any expansion or consolidation of regulatory duties has the potential to expose practitioners to responsibilities which might not be compatible with their knowledge and experience. This paper provides a framework for the identification of potential gaps in practitioner knowledge associated with proposed changes to the Irish regulatory process using the UK models for comparison. Firstly, through a review of primary legislation and statutory instruments as well as legal and professional guidance documentation, a process model for building regulation enforcement in each of the selected building control authorities is articulated and compared. The structure of each of the models is underpinned by the relevant academic literature relating to regulation and governance. The stages of enforcement and the associated tasks are mapped to the individual practitioners involved. A methodology is then proposed for subsequent research into the roles, duties, experience, knowledge base and skills of these individual practitioners within the process.

Keywords

Building regulation, Ireland, enforcement, process model

A Concise BPE for Elementary Schools

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Abstract

The principal method used for identifying the energy performance of school buildings in the UK is the Display Energy Certificate. This is a statutory requirement and it offers a benchmark for the building enabling it to be compared with other similar school buildings and to gain an understanding of how well the building is performing. This data can be misleading as it does not specifically look at what is achieved with the energy being used or how well the building performs in serving the needs of its occupants or its environmental impact. The research methodology adopted to investigate how this process might be improved upon involves undertaking a detailed Building Performance Evaluation using all of the methods that have been developed in undertaking Post Occupancy Evaluations of recently completed buildings. The objective is to examine, not how well the building is performing in relation to its design performance specification, but to understand what it achieves with the energy that it uses, the environmental impact and the occupier satisfaction. The investigation should identify weaknesses in designs in achieving optimum teaching conditions and focus upon the priority of correction in light of rapidly increasing energy costs. The research may also confirm that the academic performance of the children in classrooms that are maintained at the optimum micro-environmental conditions justifies the expense to achieve those conditions. It may also confirm that there is a much more important set of data to gather in making a building performance statement about an elementary school building.

Keywords

Primary School, Energy Use, Building Performance Evaluation, Optimum Teaching Conditions.

Regulations and standards in the Project Management Profession in the United Kingdom

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Abstract

The importance of the project management profession in the property and construction industry was brought to the public attention by the successful delivery of the London 2012 Olympic Games. Historically, the construction industry in the United Kingdom has a mixed reputation for delivering large, complex capital or infrastructure projects in a timely manner, specified quality and to the agreed budget. It is recognised that regulations and practice standards of the project management profession have had an influence on the development of effective and successful project delivery. The proposed research of the “Regulations and Standards in the project management profession in the United Kingdom” is in its infancy stage and aims to evaluate the impact that various regulations and standards have on the project management profession. The purpose of the research is to consider different aspects of the development and evolution of the project management profession within the construction industry. The professional institutions have produced extensive professional standards and technical guidance on the practice of project management. The research will also question if the recent activity by international conglomerates in mergers and acquisitions among the professional multi-disciplinary surveying practices will change the practice of or implementation of project management practice.

Keywords

Project management, professional standards, regulations.

Development of a Framework for the Nigerian Construction and Demolition Salvage Market

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Abstract

The congregation, proceedings and outcome of the recent Rio+20 conference held in Rio de Janeiro in June 2012 further reinforced the importance that the issue of sustainable development has assumed in the global agenda. This is due to the realisation that humankind, despite the technological advancement, is only a part of the natural ecosystem balance and our continued survival depends on the continued functioning of the natural life support systems. This fact makes the maintenance of the natural systems a collective and individual responsibility; thus, the environmental concerns and the intricate relationship of socio-economic conditions with the environment are key issues. Waste in general, and construction and demolition waste in particular, form a significant part of the sustainability program especially since the issues of resources depletion and pollution are paramount. In the UK, a Green Building Council report indicates that buildings are responsible for an annual waste of 109 million tonnes - around threefold that of households. Conversely, notwithstanding the dearth of literature on the topic for most developing countries, a simple reconnaissance survey shows that there is virtually no construction and demolishing waste in Nigeria, but rather, marketable products for a thriving salvage market. However, this market is informal and not guided by any deliberate policy, but developed organically. The aim of this study is therefore to investigate the characteristics of the Nigerian salvage market with the aim of deducing the framework by which it is operating. A qualitative approach through interviews and observations of the major stakeholders in the market is intended to be employed for the collation of data. Examination and analysis of the data is expected to reveal that in reality, an informal framework that can be reinterpreted guides the interaction of the various stakeholders in the Nigerian construction and demolition salvage market and can be reinvented into a formal framework. The outcome of the study is hoped to be a guiding template for policy development and practice for waste management.

Keywords

Construction, Demolition, Nigeria, Sustainability, Waste.

Adaptive Thermal Comfort Methods for Outdoor Pedestrian Spaces

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Abstract

Thermal comfort is human's satisfaction with the thermal environment, depending mainly on the microclimatic parameters, such as air temperature, mean radiant temperature, air velocity and relative humidity, as well as on personal factors, including human activity level and clothing isolation ratio. The absence of thermal comfort in many outdoor pedestrian spaces remains a major issue of concern. This is because of the increasing heat in cities as a consequence of urbanisation and high density buildings; use of dark surface materials with high absorption to solar radiation; the heat generated from the burned fuels of cars, air-conditions and industrial facilities; as well as the continuing reduction process of vegetation in cities which can have negative effects on the thermal environments. The study will attempt to suggest methods of enhancing pedestrian thermal comfort in outdoor microclimates, which can encourage people to spend more time outdoors. There are five urban interventions strategies, such as cool surface materials, wind movement with buildings arrangement, water features, vegetation and shading elements, which may consider as promising techniques to mitigate the urban heat stress. These heat mitigating techniques have a significant influence on the microclimatic parameters. The study will be conducted with the aid of the Computational Fluid Dynamics (CFD) simulation technique to simulate the cooling effects of urban interventions on the thermal environment. A case study of a typical pedestrian road in Saudi Arabia will be presented and compared with a proposed 3d concept as a solution for the enhancement of outdoor pedestrian thermal comfort. A framework model for the assessment of the outdoor thermal comfort on the proposed 3D model will be presented by using the joint process of CFD simulation technique and human thermal comfort indicator software to achieve better urban design with thermal comfort.

Keywords

Enhancement Approach, Microclimatic Parameters, Outdoor Pedestrian Spaces, Thermal Comfort, Urban Interventions.

Effective application of Building Information Modelling in professional services organisations

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Abstract

The UK Government's 2011 Construction Strategy requires that Building Information Modelling (BIM) be used on all publicly funded projects from 2016. This has led to the entire construction industry going through a process of reflecting on current practices and implementing change programmes to ensure that businesses can deliver to the new requirements. The benefits of BIM are well understood during the construction and operational phases of built assets, but are more elusive during the design development stages. This EngD research is looking at how BIM processes can offer value to designers and consultants, as well as improving the quality of information for downstream users. A small number of centres of excellence exist which are driving the implementation within their organisations. However the vast majority of those involved in construction do not understand fully what is meant by BIM. There is great inertia in changing a way of working which has been embedded over centuries. The complex nature of the construction supply chain means that a unilateral adoption of this new way of working will present many challenges, presenting a risk that many are reluctant to take. However, BIM adoption may be essential to survive and successful early adoption could lend a strong competitive advantage. The researcher is based in the Systems department at the University of Bristol and is placed with Parsons Brinckerhoff (PB), a leading professional services organisation in a range infrastructure sectors. As PB is part of the Balfour Beatty Group of construction companies the researcher will have access to stakeholders from the entire infrastructure lifecycle. Action research may be appropriate due to the urgent needs of industry. The research is still in the problem exploration stages and will apply a systems thinking approach to the methodology which considers both technical and human factors and how they interface.

Keywords

Building Information Modelling; Virtual Design and Construction; Construction; Consultancy; Systems Thinking.

The Change laboratory approach: reshaping distance learning practices in KAU

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Abstract

Due to the constant development of online programmes, and the diversity of their consumers, alongside the different technologies and practices, distance-learning institutions around the world have begun to face many challenges regarding the needs of their consumers. Most importantly, the cultural contexts that these distance learning institutions exist in. In Saudi Arabia, distance learning institutions have developed a promising distance-learning experience in the Arab world by constantly competing to provide a variety of distance-learning programmes. Accordingly, distance learning practices in the country have become a pivotal point of interest for the Saudi government. Although gender, and religion, among others, play a key role in defining the Saudi culture, distance-learning practices in Saudi Arabia in most respects have copied Western practices that were accepted by the administrators in high positions, rather than its core recipients. Consequently, the high dropout rate in distance learning was an alarming indicator of the students' wide rejection. The study aims to reshape the current distance learning practices in KAU to suit the Saudi students' context. Through collaborative effort (the Change laboratory approach), the students will play a key role in identifying the practices that hinder their success and will be involved in the process of reshaping them to fit their context. The study will use online text-based focus groups to collect data from the students to serve two purposes. Firstly, to identify the practices that are viewed by the students as obstacles and secondly, in the final stage, to evaluate the resulted solutions. Moreover, online text-based consecutive conversation sessions (Change laboratory) will be conducted whereby Administrators, faculty members, IT specialists and students are ought to cooperatively reshape the current (problematic) distance learning practices. Data will be analyzed thematically through the lenses of the activity theory (expansive learning) using the expansive action cycle model. This study will lead to the creation of new localised practices/standards that are driven by the interaction and contradictions between subjects inside distance learning activity in Saudi Arabia. The study will offer a new contribution to the body of research in Saudi locally and globally by adopting a new approach to help to develop localised practices in distance learning. Furthermore, it will create a community of subjects who constitute the distance learning community (students, faculty, IT specialists, Administrators), which help to enhance the perceptions of their roles and objectives.

Keywords

Distance learning, Activity theory, Culture

Improvement of Healthcare Services in Low and Middle-Income Countries through the Development of a Successful Outsourcing Plan

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Abstract

Traditionally, outsourcing in healthcare has primarily been driven by cost effectiveness objectives and a focus on core business strategies in order to improve the quality of services. However, in low-income countries different challenges necessitate a more comprehensive approach to improve the quality of care. The aim of this study was to reform healthcare system in low and middle-income countries (LMIC) through exploring outsourcing options and investigate management views of the impact of the outsourcing to improve of quality of care. Survey performed at major hospitals serving 2.5 million people in Taiz province in the Republic of Yemen. The research indicated that the LMIC healthcare system would benefit from a contribution from NGOs in collaboration with government and other stakeholders. The healthcare systems in LMIC must incorporate different approaches in implementing outsourcing plan that address community training and education needs.

Keywords

NGO, Healthcare, Low and middle income countries, Outsourcing, Yemen.



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